Handbook for State of the Watershed Reporting:

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A Guide for Developing State of the Watershed Reports in Alberta

water for life

Alberta

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Preface

Throughout the province, Albertans are increasingly becoming more aware of the pressures upon their water resources, of the linkages between land and water, and of the need to take steps to protect their local watersheds. This recognition of the need to adopt a watershed approach to water management is in fact the focus of Alberta's *Water for Life* strategy.

Over the years, a great deal of data has been collected by governments and other agencies, however, the challenge has always been how best to share, report, and use this information to improve decision-making on watershed management. Characterizing the current state of one's watershed, its problems, and the pressures upon it can provide the basis for developing effective management strategies to meet watershed goals. This, along with the desired *Water for Life* outcome that "Albertans have the knowledge, tools, and motivation to implement actions that will maintain or improve the province's water resources," was the impetus behind drafting the *State of the Watershed Reporting Handbook: A Guide for Developing State of the Watershed Reports in Alberta*.

This handbook introduces users to the concept of watershed-scale assessments via watershed health indicators, and includes an extensive listing of data and information sources from across the province. It is intended to serve as an informative reference guide to "non-technical audiences" interested in assessing and reporting on the state of their local watershed. Although this level of reporting is expected of the province's Watershed Planning and Advisory Councils, it is also recognized that a number of local community-based watershed stewardship groups are also pursuing development of state of the watershed reports to assist them in better directing their stewardship activities. Regardless of the scale of the assessment, the handbook will assist users in understanding the purpose and process of evaluating the current state of their watershed.

It is envisioned that state of the watershed reports will precede and inform ensuing outcome-based watershed management plans that will contribute to the achievement of the goals of *Water for Life*. Subsequent watershed assessments may also be undertaken to evaluate the effectiveness of actions being taken as part an adaptive watershed management planning process.

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1.0 Introduction to the Handbook

1.1 Purpose and limitations of the State of the Watershed Reporting Handbook

For many local and regional watershed groups, getting a clear understanding of the current state of their watershed is an important and insightful exercise as it will help to identify potential problems and concerns in their watershed. In doing so, it will also assist in guiding and prioritizing future stewardship activities. Recognition of the need for a tool or guidance document to assist watershed groups in the compilation, analysis, and presentation of this information, led Alberta Environment to develop this State of the Watershed Reporting Handbook. It introduces a basic process that could be undertaken at any scale and/or on any landscape, for gathering and evaluating information to develop an understanding of past and current watershed conditions and the influencing factors.

This handbook was not developed as a "cookbook" for conducting a state of the watershed assessment, nor does it regiment the format or content of the reports. It is meant to provide some consistency in state of the watershed reports across the province. Recognizing that not all watershed assessments will consider the same issues or require the same level of analysis, this handbook is intended to provide users with a starting point for compiling and evaluating existing and available information for the purpose of completing a broad-scale screening of the physical features, resources and conditions of a watershed. As such, the information outlined in this handbook should not be considered as rules for state of the watershed reporting, but instead as more of a "what-should-I-consider" and "where-do-I-go-for-information" guide for watershed groups interested in pursuing an assessment of the state of their watershed.

Although it is recognized that a comprehensive state of the watershed report may include aspects of environmental, social and economic well-being, the information outlined in this handbook will focus primarily on measures of a watershed's environmental condition. Additional information may be included in individual reporting efforts but are beyond the scope of this handbook.

1.2 Intended users of State of Watershed Reporting Handbook

The primary audiences for this handbook are the province's Watershed Planning and Advisory Councils (WPACs), community-based watershed stewardship groups (WSGs), and local governments. The information and guidance described in the manual will also be useful to government and agency representatives, consultants, researchers and academics, and other stakeholder groups interested in assessing environmental conditions and setting and achieving environmental outcomes within their watershed.

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2.0 State of the Watershed Reports

2.1 What is a state of the watershed report?

Often the first question asked when discussing local issues and opportunities related to a water body is "*What is the current condition of my lake, stream, or watershed?*" This inevitably leads to additional questions, such as "*How does this compare to conditions in the past? What factors are contributing to the current condition? How does my lake/stream/watershed compare to others in the area and throughout the province?*" Together, these questions are essentially asking "*What is the state of my watershed?*"

To answer this question, one must conduct an overall assessment of the watershed. A watershed assessment is a process that characterizes a watershed's current condition by evaluating how well a watershed is working. It is a descriptive survey or inventory of the existing natural and cultural resources within a watershed, including an analysis of how landscape and hydrologic systems interact and function within that watershed. The state of the watershed assessment process includes examining the history of the watershed, describing its features, identifying issues and concerns, evaluating the condition of the resources within the watershed, and determining the impact of human activity. A state of the watershed assessment has often been likened to a medical screening for human health; it identifies potential problems and issues that require further investigation.

A state of the watershed report documents and interprets the findings of the watershed assessment process. But more than an encyclopaedic collection of information about the watershed, a state of the watershed report should also identify or suggest what factors are, or may be, contributing to current conditions. That way, the assessment can serve as a compass to help direct future activities, including the development of integrated watershed management plans. By communicating an evaluation of a watershed's health (ie: its ability to provide the desired ecosystem goods and services such as safe secure drinking water, reliable quality water supplies for a sustainable economy, and healthy aquatic ecosystems), a state of the watershed report further serves as an effective tool for increasing social awareness of local conditions and issues, and mobilizing others to action.

It is important that everyone involved understand what a watershed report is, and is not.

A state of the watershed report **is:**

- The scientific interpretation of watershed information and data, leading to conclusions about watershed condition;

- An objective tool that uses available data and information to assess conditions and concerns within a watershed, as well as identify information gaps;
- A report on the analysis and findings of the watershed assessment that by identifying factors potentially contributing to concerns within the watershed, can be used to develop appropriate actions; and
- A component of a watershed management package that leads to planning, implementation, and evaluation.

A state of the watershed report is not designed to address all community concerns or issues, and should not be considered as:

- A plan; or
- An endpoint.

2.2 Purpose of a state of the watershed report

By understanding that a state of the watershed report is essentially a compilation and scientific interpretation of existing and available watershed information and data, leading to conclusions about the condition of that watershed, one should begin to grasp the potential to be derived from this exercise. Completing such a watershed assessment to understand a watershed's current condition and how it got there, is often an important first step in developing a strategy toward improving and protecting the watershed's condition.

Specifically, a state of the watershed report should contribute to:

- an understanding of how natural features and processes influence watershed conditions;
- insight into the linkages between watershed health and land and water uses;
- identification of priority watershed risks, and an evaluation of the individual and cumulative effects of water and land management practices; and
- the validation of public perceptions as to stressors and conditions within the watershed.

Documenting watershed assessment findings in a state of watershed report will substantiate potential concerns, may identify information gaps, or make recommendations on the collection of additional data not currently available. The report may function as a catalyst to establishing a community-based watershed group or may provide an already-established group with the information needed to recognize watershed risks, problem areas and activities, set priorities, develop specific preservation and restoration goals, target rehabilitation and protection activities, and develop implementation plans for protecting and improving watershed health. Because the state of the watershed report is a detailed record

of current conditions and characteristics of this unique watershed, it also has the potential to serve as a benchmark to measure future environmental change, and should help in developing monitoring strategies to assess the progress of your stewardship efforts or another agency's performance.

The process of drafting a state of the watershed report may itself also provide a number of additional unanticipated benefits. The assessment process not only brings together relevant information, it brings together people with a shared vision of their watershed that will become instrumental in the development and implementation of subsequent plans and activities. Your inquiries will help you meet knowledgeable people, locate valuable information sources, and perhaps even alert you to interests or issues that may not originally have been considered by the group.

Although some state of the watershed reports include recommendations for particular restoration, management, policy, or monitoring actions, it is preferred that any follow-up recommendations for action be outlined in subsequent restoration or watershed management plans (see Section 7.0 — Where to From Here).

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3.0 Planning a State of the Watershed Report

3.1 Things to consider

Before committing to undertake a state of the watershed report, your group should be clear on the purpose and intent of this undertaking, and also have a common vision of what they anticipate to achieve by doing so (ie: what are the desired outcomes?). Ultimately, a watershed assessment should provide an overview of conditions within the watershed that may validate concerns and answer questions of the local community, stakeholders, and regulators. If there are no fundamental questions to be answered by a state of the watershed report, your group may wish to reconsider the need for and value of this undertaking.

Other considerations will include the availability of time, expertise, interest, information, and, of course, money. All of these will influence the scope and inclusiveness of the report. It is important to balance the needs and desires of the community with the expectations of any funding agencies or regulatory bodies.

If your group is still committed to pursuing drafting a state of the watershed report, then answering the following questions should assist in framing the assessment and the final document:

a) Purpose: What is the general purpose of the report? An important consideration when undertaking an assessment of your watershed is to identify the potential uses of the report. Utilities may include:
   - Providing background for future watershed planning;
   - Drawing attention to regulatory concerns;
   - Identifying sensitive or at-risk areas and/or threats arising from particular practices;
   - Identifying information and/or knowledge gaps pertaining to the health of the watershed;
   - Informing restoration and/or enhancement initiatives; and/or
   - Monitoring improvements and/or measuring effectiveness of past efforts;

b) Scale: What spatial scale is most appropriate? Basin? Watershed? Sub-watershed? Reach? Consider the scale at which issues or opportunities exist, and that may be most appropriate for subsequent action.

c) Resource Categories: What elements of the local environment are to be reported on? (See Section 4.1 — What to include in a state of the watershed report)

d) Indicators: What indicators will be used? What information is required? What parameters should be considered or measured? (See Section 4.2 — Watershed health indicators).

e) Frequency: Will the assessment be repeated in the future? If so, how often? Will the report be updated, or is it to be a living document to which new information is continually added as it becomes available or is learned?

f) Audience: Who is the intended audience? Identifying the target audience for the assessment is important both for refining the assessment's purpose and for developing and writing the assessment. Determining the best method of communicating the report depends on the audience you are trying to reach.

g) Format: What will the final report look like? What reporting format is to be used? Comprehensive technical report? Summary report? Report card? Will you print and distribute paper copies? Will it be a living web-based report? GIS-based? Ensure the product(s) are appropriate, accessible and useful to your target audience. (See Section 6.0 — Presentation of Findings).

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3.2 The watershed assessment process

The next step is to define a process and identify what resources (technical, personal, and financial) are available to you. To compile the information, carry out the assessment, and report on the state of the watershed, some groups will contract a professional consultant, some may find volunteer experts to support them through this exercise, others may use a combination of the above. The path selected will depend largely on the capacity of the group, the scope of the assessment, the availability of information and resources, as well as any time constraints the group may be facing.

As mentioned previously, the intent of this handbook is not to dictate the process for completing a state of the watershed report — it does recognize that there are a few basic steps that should be followed:

(1) *Planning the watershed assessment* — as discussed in the previous section, this initial scoping step entails clarifying the assessment's purpose and focus, and developing a game plan for carrying out the assessment and delivering a state of the watershed report.

(2) *Characterizing the watershed* — identifying what data is available and from whom, and then collecting it is likely to be the most arduous task of the watershed assessment process. Unfortunately there is no single source of data. Government departments, regional and local authorities, private industry, educational institutions, NGOs, and others may all hold relevant information on conditions within your watershed (See Section 5.0 — Sources of Information for more detail).

Also important in this step is recording any data or knowledge gaps that become obvious when gathering and analyzing watershed information. This will inform people as to how extensive the knowledge base is, and may suggest future monitoring and data collection activities that would allow for a more comprehensive assessment of conditions in the future.

(3) *Analyzing and presenting data* — interpreting data as to what it means in relation to the condition of your watershed and the resources within it is key to the watershed assessment process. For example, a coliform bacteria count of 1,200 organisms per 100 mL, or a dissolved oxygen concentration of 3.2 mg/L, or agricultural land covering 60 per cent of the watershed, or the finding that a fish community has a disproportionate age distribution, means little to most people until this measure is compared to some reference, whether it be established guidelines, objectives, historic conditions, or even conditions in other watersheds or water bodies. Guidelines and objectives may exist for some indicators, while for others it may be necessary to set targets or

establish ratings (for more on indicators, see Section 4.2 — Watershed health indicators). Deciphering changes and trends in measured parameters over time will provide further indication of the current health of your watershed.

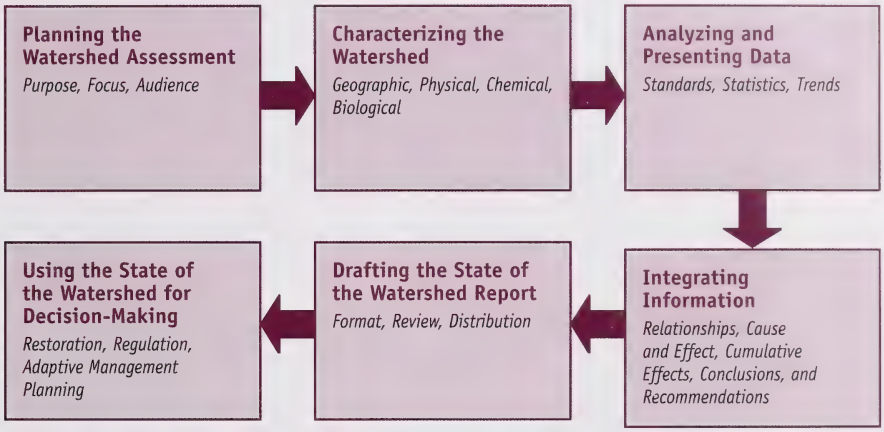
(4) *Integrating information* — as mentioned previously, a state of the watershed report is more than an inventory of resource information on a particular watershed. Information typically grouped into distinct categories also needs to be synthesized to determine the relationship and interactions between pieces of information and evaluate the cumulative effect of land management practices over time. The report needs to move beyond a simple watershed description or what historical activities occurred, and connect past and current human activities and land uses to observed watershed processes and current conditions in order to flag areas of concern and direct the focus of future activities.

(5) *Drafting the state of the watershed report* — knowing what information to include in your report and then tailoring the report to your intended audience(s) will go a long way to ensure that the findings and conclusions derived through this process are used and referred to by others (see Section 4.1 — What to Include in a state of the watershed report; and Section 6.0 — Presentation of Findings).

(6) *Using the state of the watershed for decision-making* — the product of the assessment is not the end-point; your report should lead to action and be used to support future decision-making processes (see Section 7.0 — Where to From Here).

Throughout this process, communication with local and provincial stakeholders is crucial to not only the successful completion of the assessment and report, but also to the adoption of the findings and recommendations from the report. Building community awareness about the state of the watershed is not only about informing landowners and stakeholders of the conclusions of the assessment; it is also about building stakeholder understanding of and support for the process. To ensure that the report is accepted and utilized, two-way communication should begin at the onset of the earliest discussions of conducting a watershed assessment.

Figure 1: Watershed Assessment Process



More detailed information on steps and processes for conducting watershed assessments and drafting state of the watershed reports can be found in the references listed in Appendix C: References — Watershed Assessment Guides and Manuals.

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4.0 Components of a State of the Watershed Report

4.1 What to include in a state of the watershed report

As described in the previous section, your state of the watershed report should answer fundamental questions surrounding the health of and stressors affecting your watershed. Many will attest that data compilation can be a seemingly endless process, as there are numerous sources, and there will always be something more to add about your watershed. It is important to determine what issues you intend to address, and what information you need to compile. You can then tailor your data-gathering efforts accordingly, so that time, effort, and money are not spent gathering information that will not help you understand the watershed problems nor meet your goals. The content of your state of the watershed report and the data gathering process should be tailored to the characteristics of the watershed in question, the concerns and priorities of the local community, and the technical tools, resources and information available.

As state of the watershed reports evolve and become more routine in Alberta, the potential exists for this information to be compared across watersheds and used beyond the boundaries of that watershed. For example, larger state of the basin reports could be developed from compilations of individual watershed/ sub-watershed state of the watershed reports. Standardized and focused reporting across watersheds and basins could even contribute to broader provincial evaluation and communication on the overall state of the environment and on progress to protect it. In this way, the findings outlined in state of watershed reports may provide valuable baseline environmental information for use in municipal and regional land-use planning efforts.

The following table of contents suggests and describes important information pieces that may be included in a typical state of the watershed report. The overall topics and level of information presented here may go well beyond the scope of what you are considering for your assessment. This is done intentionally to make you identify those key characteristics that define your watershed and potentially influence conditions within it. Keep in mind that there should be a logical purpose for any information you intend to obtain and use; not all information mentioned here needs to be incorporated into every state of the watershed report.

Generic table of contents for state of the watershed report

1.0 Introduction

1.1 Purpose of the report

- *The state of the watershed report should provide a benchmark against which the effectiveness of future stewardship activities and best management practices aimed at improving watershed health can be assessed. The information should provide landowners, stakeholders, municipalities and stewardship groups the information needed to make sound management decisions aimed at implementing beneficial management practices and developing possible solutions to protect and enhance their land and water resources. Although the report will not identify specific solutions to issues within the watershed, it should prioritize the issues to be addressed and make recommendations toward the development of a strategy to address those issues and opportunities.*

1.2 Scope of the report

- *The report should summarize current and historic known, existing, and available information on your watershed. It may include information on the watershed, stream and lake water quality/quantity, presence/absence of biological species, land-use and the potential effect of resource and land-use practices. Each section of this report is intended to provide and summarize known information (social, physical, environmental).*

1.3 Approach of assessment

- *The report should consider the physical aspects of the entire watershed, first at a broad scale, then focussing on the specific land, water, biological and even air resources.*

1.4 Description of format and content of report

- *This section should provide a brief overview of the layout of the report and the manner in which the information is being presented.*

2.0 Public perception and concerns

- *The objective of this section will be to highlight current and/or previously identified public concerns so that they may be used to provide direction/focus to the report, and perhaps also identify issues to be addressed through the findings of the report. Information may come from previous municipal or other surveys, interviews, public meetings, letters to the editor, statements of concern, etc.*

3.0 Existing plans and programs

- *Review of existing or proposed local county/summer village bylaws, ordinances, area structure and municipal development plans. Review should also consider current or past municipal initiatives and programs intended to safeguard lakes/ watershed/wildlife habitat. This information may illustrate how the local municipalities, agencies, and/or stakeholders are addressing local issues, and may also highlight opportunities for improvement.*
- *It will be beneficial to identify past and current watershed stewardship projects/ programs/ efforts within the watershed.*
- *Review should highlight any existing watershed management or land-use plans for the area within the boundaries of the watershed.*

4.0 Watershed characteristics

4.1 General description of watershed

- *General description of watershed (location, size, boundaries), including identification of relevant sub-watersheds within the larger watershed. This section will set the geographical context of the watershed within the larger region, and also delineate the smaller sub-watersheds that exist within. This may also provide opportunity for smaller scale investigations into localized issues and opportunities.*

4.2 Climate

- *Local climatologic data (precipitation, temperature, wind). This information may be used to characterize seasonal weather and runoff patterns in the watershed, to understand the local water budget for the region, and also for modeling purposes.*

4.3 Land cover (wetland, forest, grassland, cropland, bare)

- *Geographical breakdown of land cover (public/private/agricultural/ residential/forested/ natural) within the watershed and sub-watersheds as interpreted from available satellite, air and/or orthophotos. A chronosequence of current and historic air photos, combined with ground surveys, could be used to illustrate trends in land cover and conversion over time. Different land cover types have different potential impacts on water quality, quantity, and other resources.*

4.4 Wildlife resources

- *Description of types of wildlife and their habitat requirements (particularly species at risk). This information may identify critical wildlife habitats to protect, and may also identify pollutant sources associated with wildlife (eg: seasonal flocks of waterfowl may be an important source of bacteria and nutrients affecting water quality).*

- *Review should assess fragmentation, connectivity, and configuration of wildlife habitat (terrestrial and aquatic).*

4.5 Geography, soils and topography

- *Description of bedrock and surficial geology, soils, topography, elevation, and landforms. This information may identify areas of groundwater recharge/discharge, areas at risk of groundwater contamination, soil erosion, etc.*

4.6 General hydrology and drainage infrastructure

- *General overview of surface resources, drainage patterns and infrastructure (eg: dams and diversions), volume to area ratio, lake residence times. This section may also consider the water balance that exists between the lake and its watershed. Those contributing/non-contributing areas within the basin and the extent of contribution should be identified, outlining areas to consider for potential source water protection.*

4.7 Groundwater resources/aquifers

- *Overview of known groundwater resources in terms of volume, depth to water table, direction of flow, yield, recharge rates, and potability. Section should include discussion on the importance and usage of groundwater within the watershed, either as a domestic/industrial water source or its contribution to lake volumes or river flows. Discussion may also include inventory of known and licensed groundwater withdrawals.*

4.8 Air quality

- *Overview of known information on status of air quality, trends, sources of contaminants (eg: major urban centres, industrial plants), etc. Summary should include discussion on any air quality public advisories, and known or potential impact upon other media (water, land).*

5.0 Land use and social/cultural resources

5.1 History of human settlement

- *Information on history of development (urbanization/industrialization/agriculture), description of communities, demographics, resources, and cultural values. This section begins to assess the development pressures upon the local resources and provides a chronological perspective of local development activities. Acknowledging and honouring the past, before proposing changes to current activities and lifestyles, will create a deeper sense of ownership within the community, and may result in more engagement and buy-in to the project.*

5.2 Land use

5.2.1 Land resources overview

- *Land uses (eg: agricultural, residential, commercial, recreational, industrial, transportation and utilities, resource extraction, protected, etc.) are an important factor influencing the physical conditions of the watershed and may be associated with particular pollutant stressors or sources.*
- *Evaluating land use distribution may guide/direct implementation of future beneficial management practices and/or stewardship programs, while also identifying areas currently being protected or in need of protection, and also potential stakeholders.*

5.2.2 Agricultural resources

- *Overview of agriculture in watershed/subwatersheds, breakdown of agricultural lands (cropland/forage/pasture), farm type/ size/abundance/ distribution, agricultural production and livestock density/placement, trends/threats/opportunities in agriculture. Knowledge as to the type, intensity and location of agricultural practices (eg: tillage, fertilizer/pesticide applications, etc) may highlight potential issues and also potential partnership opportunities.*

5.2.3 Forestry resources

- *Inventory of timber resources (type, volume, age) and overview of forestry activities (past/current/planned). A review of detailed forest management plans within the watershed offers the opportunity to incorporate current and future harvesting plans and practices into the assessment.*

5.2.4 Recreational resources

- *Inventory of permanent and seasonal lakeshore or other residential/commercial developments, recreational facilities/ areas (eg; beaches, parks, campgrounds), planned and potential expansions, usage rates, services, waste production and disposal facilities, trends/threats/opportunities in recreational activities or investments, mapping of shoreline municipal and environmental reserves, review of shoreline development and municipal land-use zoning planning processes. Similar to the overview of agricultural resources, this inventory may highlight potential issues and partnership opportunities.*

5.2.5 Other human/industrial influences

- *Assessment of oil & gas/mining/gravel extraction/other industrial activities. Assessment should include discussion on potential impacts to arise from current and future levels of resource development.*
- *Knowledge of these activities will be important in identifying potential watershed stressor and pollutant sources, and areas for additional or future management efforts.*

5.3 Water supply and wastewater systems (municipal, private)

- *Identification of all sources of drinking water within the watershed, description of water treatment processes and any delivery infrastructure, as well as processes for local treatment of wastewater (lagoon, septic fields, land-spreading of septage, etc). Discussion of any future plans for expansion of supply systems, and/or other actions to meet future demands.*

5.4 Riparian health assessments

- *Review of any available shoreline assessment and riparian health data collected within the watershed. Issues of stream/lake water quality/ quantity may be related to riparian health and management. Any assessment of shoreline and riparian areas may assist in identifying beneficial actions to be taken and programs to be implemented. The level and impact of nuisance beaver activity within the watershed may also be considered in this section.*

5.5 Wetland inventory

- *Review of wetland inventory findings where such an inventory has been conducted. Section should include snapshot of current wetlands and wetland conditions, and discussion on any change in wetland number, type, and surface area from known historical conditions. Consider discussion on calculated cumulative loss/gain of storage volume and associated impact on runoff rates, soil moisture conditions, etc.*

6.0 Surface water quality

6.1 Water quality parameters (historic, current, trends)

- *Record of water quality monitoring initiatives, and assessment of chemical, physical and biological data for lakes within watershed (eg: bacteria, nutrients, dissolved oxygen, transparency, chlorophyll a, caffeine). Being the downstream point of accumulation for the watershed's catchment area, the health of the lake is often indicative*

of the health of its watershed. Based on findings, report should identify potential point/non-point sources, internal/external sources.

- *Paleolimnological studies may also provide insight into historic, pre-settlement water quality conditions of the lake and its watershed, and provide some context as to natural water quality conditions.*
- *Record of water quality monitoring initiatives and assessment of chemical, physical and biological data for tributaries within watershed (eg: bacteria, nutrients, dissolved oxygen, transparency, chlorophyll a). Combined with stream flow data, this information can be used to calculate nutrient loadings. Assessing and comparing the quality of water in the various tributaries will also assist in prioritizing stewardship projects and activities.*

  Note: Water quality is one of the primary measurable, non-biological indicators of watershed condition.

6.2 Point source discharges

- *Identification of the location of any known pollutant point sources (stormwater outflows, treated wastewater release sites, industrial discharges, etc), and summary of conditions imposed on these.*

6.3 Aquatic ecosystem health (biological indicators)

- *Assessment of current and historic fish habitat inventory data. Records of catastrophic and seasonal events, such as recorded winter fish kills, algal blooms, or changes to diversity of aquatic species (extirpations/ introductions) may be incorporated. This information may be used as an indicator of water quality and may also highlight particular environmental threats or reoccurring events that should be considered.*

6.4 Public health

- *Section should include discussion of any recorded public beach closures, fish consumption advisories, boil water advisories, etc, along with description of factors or events contributing to and following public health advisories.*

7.0 Surface water quantity and management

7.1 Hydrology and lake levels (historic, current, and trends)

- *Record of lake level fluctuations (in isolation and/or in relation to other local lakes), river/stream/tributary base flow, inventory and management of lake/river/drainage/ storm-water infrastructure, history of flood/drought events. Delineation of 1-in-100-year floodplain as it relates to recreational/residential/industrial development would also*

be informative. Compilation of this information could provide insight into events, activities, and landscape or management changes that may influence water volumes or be threatened by high/low water levels.

7.2 Apportionment and other flow agreements (sector-based, interprovincial, international)

- *Review of conditions of any recognized apportionment and other agreements influencing water flow and management (eg: interprovincial apportionment agreements, existing watershed/sub-watershed water management plans, approved diversion and dam operating guidelines, etc).*

7.3 Water allocations, withdrawals and consumption

- *Assessment of current and past licensed/permitted water withdrawals from rivers, lakes and tributaries for domestic/livestock/irrigation/industrial/wildlife usage. Data could illustrate the significance of water withdrawals in the watershed in relation to its influence on seasonal flows and lake levels.*

7.4 Instream flow needs and water conservation objectives

- *Review any studies of calculated flow needs for any rivers/streams within the watershed. Review current flow conditions compared to desired conditions and existing plans or efforts to achieve water conservation objectives (eg: Water Act license cancellations, holdbacks on water act license transfers, basin closures to new Water Act license applications, etc).*

8.0 Issues and challenges

8.1 Interpretation of state of the watershed assessment findings

- *Validation of public issues and concerns and recognition of additional threats and opportunities (including lack of planning/enforcement). This section will provide an overall summary of the issues as identified from findings highlighted in each of the above sections.*

8.2 Discussion of data and data gaps

- *Discussion of data gaps and limitations with available data/knowledge, identification of potential sources of additional data, along with recommendations for the collection of any additional data (including the means of collecting this data).*

9.0 Conclusions and recommendations

- *Discussion of where we go from here, how this data could/should be used by landowners, stakeholders, municipalities, and government in future watershed management planning and for the implementation of beneficial management practices.*
- *Discussion of role, responsibility and mandate of institutional and regulatory bodies in light of this information.*

10.0 Stewardship opportunities

- *Discussion of the role of the watershed stewardship group in terms of communications/ outreach, program/project delivery.*
    - *Recommendations for future project areas and stewardship initiatives.*

4.2 Watershed health indicators

4.2.1 What are watershed health indicators?

Healthy watersheds consist of numerous components and perform many functions that keep the ecosystem in balance. The broad and complex nature of interactions comprised within these systems makes it nearly impossible to measure watershed health directly, and it would be near impossible to measure every component of that ecosystem. As such, a set of defined easily measurable attributes that reflect the conditions and dynamics of the broader ecosystem are monitored to provide information on environmental conditions and trends (ie: whether conditions are improving, degrading or stable). Parameters may include physical, chemical, biological and socio-economic attributes. These measurable surrogates of underlying ecological functions are considered watershed health indicators.

Watershed health indicators can be a measure of a single parameter, otherwise known as a metric (eg: water temperature, E. coli concentration, or density of livestock operations), or an index that incorporates a number of metrics or measured parameters (eg: the Alberta River Nutrient Index incorporates measured concentrations of four different nutrients, dissolved oxygen and pH into a single index score). The advantages of a multi-metric indicator such as the River Nutrient Index include: its ability to represent measurements of many parameters in a single number; its ability to combine numerous parameters with different measurement units in a single number; and its effectiveness as a communication tool. Disadvantages of using an index as an indicator include: a loss of information on single variables; the loss of information on interactions between variables; and the sensitivity of the results to the formulation of the index.

Having a set of carefully selected indicators of watershed health can serve to illustrate changes in environmental conditions over time, or to measure a group's progress toward meeting the objectives or outcomes for that watershed. Ideally, information collected from these indicators will direct the activities and management of our watersheds.

4.2.2 Selecting the appropriate indicators

The selection of indicators for characterizing the health of watersheds is critical. The indicators must be comprehensive enough to capture the major components and processes that constitute watershed health, yet they must be measurable at a scale and frequency that are practical.

It should be noted that indicators selected for state of the watershed reporting (at least an initial state of the watershed report) may be different than indicators selected to measure environmental performance of a management activity within that watershed. In contrast to performance monitoring where indicators

are monitored to inform stakeholders as to where they are in relationship to their objectives (ie: the metric is tied to a target), indicators for the purpose of reporting on the general state of a watershed should reflect known issues or concerns and be selected based on the availability of the required information or data. After all, the process of drafting a state of the watershed report is intended to provide a current snapshot of conditions within the watershed, and not to gather new information or create additional monitoring exercises and responsibilities.

The development and selection of indicators is a challenging process. The indicators used to measure watershed health within a specific watershed or sub-watershed will be refined over time to reflect societal concerns, as well as an understanding of the relationships between ecosystem components. While a universally applicable core suite of indicators would facilitate standardized state of the watershed reporting, the most meaningful watershed health indicators reflect local and regional ecological realities and are watershed specific.

Characteristics of good indicators include the following:

- **Reflect watershed health** — indicators should convey an understanding of ecosystem functions by characterizing some component important to watershed health. Indicators must be applicable and measurable throughout the watershed or have a significant relevance to a portion of the watershed.
- **Objective and comparable** — indicators should be readily measurable. The underlying data should be characterized by sound collection methodologies and quality assurance procedures. The data must be comparable across time and space, allowing one to compare with historic conditions and standards within a watershed while also allowing for comparison between watersheds.
- **Sensitive to stressors** — indicators must detect and reflect changes in the environment, and in doing so, provide insight into the cause-and-effect relationships between environmental stressors and ecosystem response. The indicator must allow the observer to distinguish between inherent variability (eg: innate annual fluctuations) and a true environmental signal arising from stress upon the system.
- **Interpretable and understandable** — indicators should present information in a clear, unambiguous format understood and accepted by scientists, policy-makers and the public. A good indicator can simplify large amounts of information into a concise easily understood format, such as the Alberta Surface Water Quality Index.
- **Relevant to societal concerns** — indicators must provide information pertinent to societal concerns about local or regional ecological conditions and clearly relate to one or more identified assessment questions.

- **Measure progress** — indicators should be linked to performance indicators, and measure progress toward the community's management goals and objectives. In this way, indicators will provide meaningful feedback on priorities and the means for affectively achieving healthier watersheds.
- **Cost-effective to monitor** — indicators should be capable of being monitored at reasonable cost to provide statistically verifiable and reproducible data that shows changes in the environment. Ideally, indicators will maximize data-sharing and use of existing information and be an effective assessment of watershed health.

  Watersheds are dynamic and typically complex. A single indicator is seldom used to determine watershed health — a combination of indicators is required to assess the health of a watershed in its entirety. Taken together, a set of indicators should convey an understanding of how the components within the ecosystem interact and contribute to the watershed's current condition.

4.2.3 Potential indicators of watershed health

Three types of indicators are typically considered to exist:

- **Condition indicators** — address the state of the environment, the quality and quantity of natural resources, and the state of human and ecological health. These indicators are chosen by considering biological, chemical, and physical variables and ecological functions (eg: riparian health, water quality, fish community structure).
- **Pressure indicators** (also often referred to as stress indicators) — describe natural processes and human activities that impact, stress, or pose a threat to environmental quality (eg: human populations, livestock operations, water allocation, industrial activity, soil erosion, etc).

  Note: the existence of a pressure does not necessarily suggest that there is a negative impact, but merely the potential for one.
- **Response indicators** — illustrate individual and collective actions or management programs implemented to halt, mitigate, adapt to, or prevent damage to the environment (eg: municipal bylaws, livestock operations regulations, education or incentive programs, watershed planning initiatives, and stewardship activities).

All three indicator types are closely related. For example, the *stress* of a particular pollutant entering a system may cause a change in the *condition* of some species (ie: population decline) which may in turn cause a *response* of restrictions on the discharge of the pollutant. The additional restrictions reduce the *stress* which

improves the *condition*. Condition and pressure indicators are predominantly used in assessing the state of a watershed. Response indicators are more commonly used to identify the various efforts being undertaken to address known environmental concerns.

Indicators may be further categorized according to the watershed element they represent (ie: water quality, watershed hydrology, landscape, biological community). This categorization often assists in communicating the relationship between the indicator and conditions within the watershed.

The indicators identified in this guide are for reference only and present an extensive list to select watershed health indicators and metrics. Indicators may also be chosen on an expectation they will be useful in indicating potential management issues that should be addressed in later watershed management planning initiatives. No single watershed assessment will consider all the indicators presented. The final list of indicators will be tailored according to the watershed's issues, objectives, site-specific conditions, and information available.

Table 1: Examples of Indicators of Watershed Health

Indicator Category	Indicator	Assessment Role of Indicator	Metric (ie: that which is directly measured)	Indicator Type
Water Quality	River Water Quality Index (AENV)	Provides a general overall assessment of water quality by summarizing chemical, physical, and biological data. It reflects the impact of activities that significantly change water quantity or cause changes in inputs to rivers from either point or non-point sources.	Composite index value is calculated as an overall average of the combined index values for each of the four specific variable groups: • River Metals Index • River Bacterial Index • River Nutrient Index • River Pesticide Index	Condition
	River Metals Index (AENV)	Provides a general measure of heavy metal concentrations in Alberta rivers and streams, and identifies potentially toxic or impaired reproductive conditions for humans and aquatic life.	Subset of up to 22 metals and ions (Aluminum, Arsenic, Beryllium, Boron, Cadmium, Cobalt, Copper, Iron, Lead, Lithium, Manganese, Mercury, Molybdenum, Nickel, Selenium, Silver, Thallium, Uranium, Vanadium, Zinc, Cyanide, Fluoride)	Condition
	River Bacterial Index (AENV)	Provides an indication of bacterial contamination suggesting recent contamination with fecal matter from humans or animals. Bacteria contamination may pose a potential risk to human, animal, and ecosystem health.	• Fecal coliforms • E.coli	Condition
	River Nutrient Index (AENV)	Provides a general measure of nutrient concentrations in Alberta rivers and streams. Nutrient Index results may also be used to assess non-point source nutrient contamination.	Subset of the following six parameters: total phosphorus, total nitrogen, dissolved nitrite, total ammonia, dissolved oxygen, pH	Condition
	River Pesticide Index (AENV)	Typically used as a measure of non-point source contamination. Presence of pesticides in rivers may be of significant concern to water users (eg: drinking water, irrigation, stock watering).	Subset of 17 commonly applied pesticides (2,4-D, MCPP, MCPA, Diazinon, Lindane, Picloram, Dicamba, Triallate, Atrazine, Bromoxynil, Cyanazine, Malathion, Methoxychlor, Chlorpyrifos, Imazamethabenz, Diuron, Dichlorprop)	Condition
	CCME Water Quality Index	Provides a general assessment of water quality based on chemical and physical parameters.	Subset of the following physical, chemical, and biological parameters: chloride, fecal coliforms, copper, iron, lead, manganese, zinc, NO3 and NO2, total kjeldahl nitrogen, total dissolved phosphorus, dissolved oxygen, pH, sodium, sulphate, total dissolved solids	Condition

Indicator Category	Indicator	Assessment Role of Indicator	Metric (ie: that which is directly measured)	Indicator Type
Water Quality	Lake Trophic Status	Provides a general assessment of a lake's productivity or fertility.	Based on the following collective or individual measures: • Total phosphorus • Chlorophyll a • Secchi-disk visibility	Condition
	Nutrients	Provides a general measure of nutrient concentrations in Alberta rivers and streams and may be used to assess non-point source nutrient contamination.	• Phosphorus • Nitrogen	Condition
	Pathogens	Provides an indication of bacterial contamination that may pose a potential risk to human, animal, and ecosystem health.	• Fecal coliforms • E.coli • Entercoccii • Giardia • Cryptosporidium	Condition
	Dissolved oxygen	Provides insight into potential factors influencing the distribution and abundance of aquatic species, as well as other critical chemical processes, including the release and adsorption of pollutants in sediments. Also reflects degree of mixing of water body.	• Concentration of dissolved oxygen • Percent saturation	Condition
	Water temperature	Provides insight into the distribution and abundance of aquatic species.	Water temperature	Condition
	pH	Provides information on the chemical balance and biological state of the ecosystem.	Relative acidity of water	Condition
	Sediment contamination	Provides information on sediment supply and contaminant dynamics, as many nutrients and contaminants adhere strongly to sediment.	• Total suspended solids • Turbidity	Condition
	Individual pesticides	Provides an indication of pesticide contamination that may pose a potential risk to human, animal, and ecosystem health.	Presence/absence of select pesticides	Condition
	Individual heavy metals	Identifies potentially toxic conditions for humans and aquatic life.	• Lead • Arsenic • Cyanide • Mercury	Condition
	Wastewater loadings (municipal or industrial)	Provides an indication of direct human inputs to natural system.	• Nutrients • Pathogens • Total suspended solids	Pressure

Indicator Category	Indicator	Assessment Role of Indicator	Metric (ie: that which is directly measured)	Indicator Type
Water Quantity	Lake Level Index	Shows the status of individual lakes from year to year. This information can assist in interpreting related observations of changes in water quality, fisheries, or recreational opportunities as lake levels change over time.	Lake level elevation relative to a standard level	Condition
	Deviation of recorded flows from naturalized flows	Illustrates the extent the natural flow regime has been altered and provides insight on status of meeting any apportionment agreements.	Deviation of actual recorded flow from what would have occurred naturally (ie: in the absence of any man-made effects).	Condition
	Deviation of recorded flows from Water Conservation Objective (WCO)	Illustrates where, when, and to what extent water management targets are being achieved.	Deviation of actual recorded flow from water management targets set by Alberta Environment for the protection of that water body.	Condition
	Deviation of recorded flows from Instream Flow Need (IFN)	Illustrates where, when, and to what extent natural aquatic ecosystem components may be stressed.	Deviation of actual recorded flow from what has been scientifically determined to be required to sustain a healthy aquatic environment.	Condition
	Floodplain presence and flooding pattern	By considering where and how frequently it floods, illustrates changing conditions to floodplain ecosystems.	Area of historically connected floodplain vs. area of currently connected floodplain	Condition
	Hydrograph alteration	Reflects changes to natural seasonal flow patterns and potential impact on flow-dependent ecosystem functions.	Changes in duration, timing, and magnitude of: • Peak flow • Base flow • Seasonal patterns in hydrograph • Frequency of overbank flow	Condition
	Surface water allocations and withdrawals by sector (eg: irrigation, industrial, municipal)	Illustrates relative level of water use and withdrawal from the natural system.	Volume, rate and timing of withdrawals allocated through Water Act registrations, permits, and licenses.	Pressure
	Groundwater extraction	Illustrates level of water use and withdrawal from the natural system.	Volume of groundwater allocated through Water Act registrations, permits, and licenses.	Pressure

Indicator Category	Indicator	Assessment Role of Indicator	Metric (ie: that which is directly measured)	Indicator Type
Landscape	Wetland inventory	Reflects land use conversion from a natural to a "developed" state and identifies potential alterations to local hydrological patterns and water quality.	• Current wetland area (%) • Wetland area lost due to human activity (%)	Condition
	Riparian health	Reflects type and extent of human disturbance and degree of natural ecosystem function contributing to stream health.	• Width of vegetated zone • Species composition, age structure, and percentage of tree canopy cover within the riparian area • Extent of impervious area • Bank condition	Condition
	Land cover	Identifies habitat types within the watershed.	Impervious area, bare area, and vegetated area by vegetation type.	Condition/ Pressure
	Land use	Illustrates extent and location of natural and human disturbed areas.	Percentage of industrial, commercial, residential, agricultural, protected, etc within watershed.	Condition/ Pressure
	Terrestrial habitat connectivity	Illustrates level of human disturbance, wildlife mobility, and viability/ sustainability.	Size, shape, and spatial arrangement of habitat patches and corridors.	Condition/ Pressure
	Industrial features	Illustrates extent and location of human disturbed areas and identifies different types of pressures on local ecosystem.	Density of livestock operations (CFOs), industrial processing plants, oil and gas wells, groundwater wells, landfills	Pressure
	Human population	Provides general measure of the level of human pressure on the environment.	• Population density • Dwelling unit density	Pressure
	Livestock density	Provides measure of water quality degradation risk via contaminated runoff and effluent.	Livestock units per unit area.	Pressure
	Linear development	Provides general measure on extent of human disturbance and fragmentation.	Extent of transportation routes, utility corridors, and seismic lines.	Pressure
	Stream connectivity	Illustrates level of disturbance to natural flow conditions that could impair natural ecosystem function.	Number and impact of culverts or other natural and artificial hydraulic breaks (eg: dams, weirs, culverts).	Pressure
	Soil erosion	Identifies potential, extent of, and contribution to sedimentation impacting water quality and flow.	Rate of soil erosion (measured or model-predicted).	Pressure
	Fertilizer/pesticide application rates	Provides measure of water quality degradation risk via contaminated runoff.	• Fertilizer application rates as per Canada Agricultural Census data • Rate and location of pesticide application on land within watershed. • Record of pesticide sales	Pressure

Indicator Category	Indicator	Assessment Role of Indicator	Metric (ie: that which is directly measured)	Indicator Type
Biological Community	Index of Biotic Integrity	Reflects the quality and amount of aquatic habitat.	Subset of the following fish species richness, composition, abundance, and condition metrics: • Total number of fish species • Numbers of specific native, intolerant, and sensitive fish species • Percentage of fish that are omnivores, insectivores, and carnivores • Percent of individuals that are hybrids • Percent of individuals that are diseased or deformed	Condition
	Macrophyte community	May reflect level of eutrophication, or other condition within water body	Species composition and abundance	Condition
	Benthic macroinvertebrates assemblage	Reflects cumulative effects of chemical, physical, and biological health of watersheds. May also reflect presence, level, and type of potential pollutant.	Species composition and abundance	Condition
	Individual indicator species	May reflect level of human disturbance (eg: development/ encroachment, manipulation of water levels, recreational activities, etc).	Presence/absence of leopard frogs, piping plover, american white pelican, bull trout, cottonwoods, other species sensitive to human disturbance	Condition
	Blue-green algae outbreaks	Reflects level of water body euthrophication, and provides frequency and level of potential risk to human, animal, and ecosystem health.	Record of Cyanobacterial blooms	Condition
	Invasive/ introduced species	Confirms stress incurred by native species competing with invasive or introduced species.	Presence of purple loosestrife, common tansy, Eurasian water milfoil, Didymosphenia geminata, quagga mussels, New Zealand mud snails, spiny waterflea, other	Pressure

4.2.4 The significance of indicators

For each indicator, a range of values that defines watershed conditions as acceptable/marginal/unacceptable, excellent/fair/poor, healthy/stressed/impaired, or some other rating system deemed appropriate for expressing indicator results needs to be established. Some indicators will have institutionally-defined values that define watershed conditions, such as Federal and Provincial Water Quality Guidelines, health standards, etc, while for other indicators, ratings, objectives or targets (ie: where we want to be statements) may need to be developed locally relative to historic baseline conditions and the expectations and desired outcomes of the stakeholder community. See examples of condition rating charts on the next page.

Table 2: Alberta River Water Quality Index categories and score ranges

Water Quality	Value Range	Description
Excellent	96 – 100	Guidelines almost always met; "best" quality
Good	81 – 95	Guidelines occasionally exceeded, but usually by small amounts; threat to quality is minimal
Fair	66 – 80	Guidelines sometimes exceeded by moderate amounts; quality occasionally departs from desirable levels
Marginal	46 – 65	Guidelines often exceeded, sometimes by large amounts; quality is threatened, often departing from desirable levels
Poor	0 – 45	Guidelines almost always exceeded by large amounts; quality is impaired and well below desirable levels; "worst" quality

Table 3: CCME Water Quality Index categories and score ranges

Water Quality	Value Range	Description
Excellent	95 – 100	Water quality is protected with a virtual absence of threat or impairment; conditions very close to natural or pristine levels. These index values can only be obtained if all measurements are within objectives virtually all of the time.
Good	80 – 94	Water quality is protected with only a minor degree of threat or impairment; conditions rarely depart from natural or desirable levels.
Fair	65 – 79	Water quality is usually protected but occasionally threatened or impaired; conditions sometimes depart from natural or desirable levels.
Marginal	45 – 64	Water quality is frequently threatened or impaired; conditions often depart from natural or desirable levels.
Poor	0 – 44	Water quality is almost always threatened or impaired; conditions usually depart from natural or desirable levels.

Table 4: Cows and Fish Riparian Health categories and score ranges

Health Category	Score Range	Description
Healthy	80 – 100	Little to no impairment to riparian functions
Healthy, but with problems	60 – 79	Some impairment to riparian functions due to management or natural causes.
Unhealthy	<60	Severe impairment to riparian functions due to management or natural causes.

photo: Alberta Environment (Southern Region)

5.0 Sources of Information

Having previously identified the types of information that should be considered in developing a state of the watershed report, it was envisioned that this handbook would also direct those pursing such an assessment to known sources of available environmental information for Alberta's watersheds.

Appendix A: State of the Watershed Sources of Information outlines an extensive list of information resources, references, and agency contacts within Alberta to assist watershed groups in the collection and compilation of relevant and available information. For each information category in this appendix, the agencies/organizations/institutions holding the information has been identified along with a description of what information is available, how this information can be used, and the process for acquiring it.

A review of the literature may also reveal additional information and insight on conditions within your watershed.

photo: Travel Alberta

6.0 Presentation of Findings

Although, state of the watershed reporting is intended to serve as a communication tool, a common oversight amongst many groups developing state of the watershed reports is not giving adequate consideration to the format that would best convey the information to the intended audience. In fact, how you present your findings and conclusions will determine a large part of how people will accept your report and use the assessment information to inform their decisions. After all, other than the people directly involved in the watershed assessment process, nobody else will know of or understand your assessment unless you clearly report it and share it.

Chances are you will have identified several different audiences for your report (eg: government regulators, municipal authorities, resource users, local stakeholders, and residents). As such, identifying a presentation format that is understandable and beneficial to a broad audience is important.

Traditionally, state of the watershed reports are drafted as 50 to 200 page comprehensive technical reports complete with a description of monitoring and reporting methods, tables of indicators and data, justification for conclusions, complete references, etc. Although this format justifiably provides the most in-depth and informative account of conditions with the watershed, it is not always the most appealing to local residents or non-technical audiences. Consider perhaps also drafting a more concise easier-to-read summary of findings, not exceeding 8 or 10 pages. This type of summary appeals to the broader public who want environmental information but are less interested in the supporting documentation.

"Watershed Report Cards" have been adopted by many agencies and organizations as a quick easy-to-understand method of presenting findings and conclusions. One should note however that watershed report cards have also been used for a variety of purposes ranging from summarizing the conclusions of state of the watershed reports (eg: Ontario Watershed Authorities), to communicating the results of annual monitoring activities (eg: AESA Stream Survey water quality report cards or Iron Creek Watershed Improvement Society's riparian health report card), to reporting on the progress and achievements of stewardship and management efforts.

For the purposes of providing a synopsis of a detailed state of the watershed report, a report card is likely to provide a summary of only specific environmental indicators and attach a grade (A+ to F) or rating (excellent to poor) to each of these. The grade or rating gives readers a quick picture of the health of the

natural resource. Indicators within resource (or indicator) categories, such as those suggested in Table 1 of Section 4.2.3, may also be combined to give a single grade and score for each category (ie: water quality, watershed hydrology, landscape, and biological community). In the case of Ontario's Conservation Authorities, watershed report cards have been standardized to summarize watershed conditions through the following three priority indicators: surface water quality, forest condition, and groundwater quality. From these, an overall average grade may further be calculated to provide a picture of the overall health of the watershed. Successive report cards are a common method for reporting back on continued monitoring or subsequent assessments as they also typically include some indication of change or trend measured for each of the highlighted indicator categories (ie: are conditions improving? deteriorating? staying the same?).

The internet is yet another avenue for sharing the findings of a state of the watershed assessment. Unlike hardcopy reports, web-based reporting makes the information readily available to anyone and allows for continuous updating as new information is learned.

The best scenario may be to combine two or more different formats for publishing and distributing your report. Doing so is likely to increase the breadth of your audience and also stretch your publication budget. Developing an overall awareness strategy that outlines a process for unrolling the report, as well as additional outreach activities to increase public awareness will further ensure that your report achieves its intended goals.

Figure 2: Example of Watershed Report Card

(from Muskoka Watersheds Report Card, 2007)

photo: Cows & Fish

7.0 Where to from here?

Although, a state of the watershed report may be drafted for the sole reason of providing an informative snap-shot of current environmental conditions within a watershed, ideally, the assessment and its report should be a supporting component of a larger watershed management effort.

A state of watershed report should be designed to inform residents and decision-makers of current (and potential) conditions within the watershed with the intent of stimulating stakeholder (individual, industry, government) action to improve or protect watershed health. The process of describing, characterizing, and assessing a watershed, the activities being undertaken within or planned for that watershed, and the associated issues and opportunities will provide a basis for developing effective management strategies to meet the community's desired outcomes and watershed goals. For example, the information and conclusions outlined in the report may promote the undertaking of additional monitoring, contribute to the implementation of new or expanded educational programs, lead to the formulation or revision of provincial or municipal policy, and/or provide direction to local stewardship groups and residents as to the types of and most appropriate locations for on-the-ground activities.

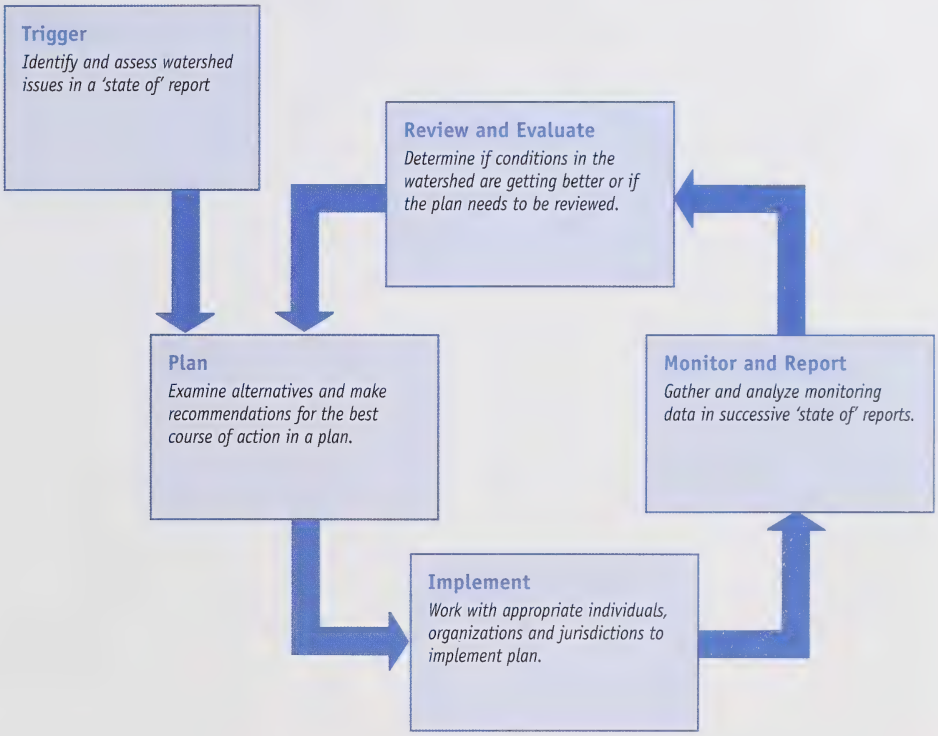
The Alberta Water Council, in their *Recommendations for a Watershed Management Planning Framework for Alberta*, also suggest that a state of the watershed report may be considered a primer to watershed management planning. Remember that the report will help to identify key issues that need to be addressed to protect or restore watershed health. From these issues, the community can then formulate desired outcomes that promote planning and lead to the implementation of actions with measureable results that in turn feed back into an adaptive and relevant watershed management process. In this way, the report will assist in defining the scope and emphasis of an ensuing watershed management plan.

As mentioned earlier in this document, completing a state of the watershed report should not be considered as an endpoint. Even as you finish your report and begin to embark on follow-up activities, you should be looking forward to regularly reviewing and updating the report. It should be thought of as a living document, to be updated and revised as new information is learned and as conditions change. The initial assessment will not only identify priority issues and opportunities, it will also identify baseline conditions from which to measure change and progress toward the achievement of goals and desired outcomes. In this way, successive reports may be regarded as "report cards" to measuring progress. The content of subsequent state of the watershed reports may also change over time to reflect this additional purpose; these reports (or updates to the original report) may focus less on historical conditions within the watershed and place more emphasis

on reporting on those indicators that reflect the performance of stewardship activities and management efforts. The monitoring of performance indicators and the tweaking of management efforts to be more effective is an essential component of adaptive management at the watershed scale.

Finally, the process of reporting on the state of one's watershed not only brings together relevant information, it brings people together — people interested, willing, and capable of making a difference within their watershed. After all, the engagement of stakeholders and the incorporation of their input throughout the process will be instrumental to garnering the community buy-in and support needed to move your watershed stewardship and management efforts to the next level.

Figure 3: An Adaptive Approach to Watershed Management



(from Enabling Partnerships — A Framework in Support of Water for Life: Alberta's Strategy for Sustainability)

photo: Travel Alberta

Appendix A
State of Watershed Sources of Information

Agricultural Activity

1. Statistics Canada

What is available?

Statistics Canada conducts an agricultural survey every 5 years in the province of Alberta. This survey shows how many head of cattle are in each county, the type of crops being produced, whether or not pesticides are being applied, percentage of land used for agriculture, land use practices and many other topics. All of the results are available free of charge to the public.

How can this information be used in a State of the Watershed Report?

This information can be used to identify potential threats to water supplies, such as large feedlot operations, pesticide application which can lead to contaminated surface runoff, etc., as well as quantifying how much land area within a given watershed is used for agricultural purposes.

How to obtain the information?

The main Statistics Canada website with the latest agricultural census data (2006) can be found at:

http://www.statcan.ca/english/agcensus2006/index.htm

Click on the topic of interest and you will be presented with the list of measured parameters. Choose the parameter you are interested in, and then click on the province of interest. The data is split into agricultural regions, so you must either know what region you are in or scroll through the table until you find the county of interest.

For further information, Statistics Canada can be reached at:

Email: **infostats@statcan.ca**
8:30am to 4:30pm Monday to Friday
Toll-free telephone (Canada and the United States):
1-800-263-1136 — Enquiries line
1-800-363-7629 — National TTY line (teletype machine)
1-877-287-4369 — Fax number

Statistics Canada Advisory Services
Harry Hays Building, Suite 686
220 – 4th Ave SE
Calgary, Alberta T2G 4X3

Statistics Canada Advisory Services
Ste 800, 10909 Jasper Avenue
Associated Engineering Plaza
Edmonton, Alberta T5J 4J3

2. Prairie Farm Rehabilitation Association

What is available?

PFRA has many maps and publications available on the topic of agricultural land use and irrigation in Alberta. There is also groundwater, surface water, water supply and livestock watering information. Maps can include information such as locations of feedlots, manure concentration, number of head of cattle, crop types, and other parameters of interest.

How can this information be used in a State of the Watershed Report?

This information would be used in the Agricultural Activity section of a State of the Watershed Report and would be useful in determining risks to groundwater and surface water. Future land use planning could be based on what is seen on the maps, and areas requiring best management practices could be identified.

How to obtain the information?

Navigate to: http://www.agr.gc.ca/pfra/main_e.htm

Click on the "Maps and Data" link to obtain maps, click on the "Publications" link to view a list of publications sorted by topic, and the menu bar on the left hand side offers options for browsing in topics such as air, soil and water. You can also complete a specific search by entering keywords into the Search box in the left menu bar.

PFRA staff can be contacted through: http://www.agr.gc.ca/pfra/regions_e.htm

Click on your area, and contact information will be provided in a new window.

3. National Resources Conservation Board

What is available?

The NRCB regulates confined feeding operations (feedlots) within Alberta. They also make decisions on developments based the effects on air, soil and water quality along with social and economic aspects. Their website shows applications for feedlot and natural resource projects and addresses manure management within the province.

How can this information be used in a State of the Watershed Report?

This information can show the number of feedlot operations existing within a watershed, which can give an indication of the potential effects to groundwater and surface water resources. This can be used to assist with the development of recommendations and best management practices, and can highlight areas of concern within the watershed.

How to obtain the information?

Navigate to: http://www.nrcb.gov.ab.ca/home/default.aspx

Click on "Confined Feeding Operations" and "Applications" to view all current applications. Click on "Natural Resource Projects" and "Applications" to view all applications relating to resource extraction. Enforcement orders, compliance, applicable legislation and withdrawn applications can be viewed as well.

The NRCB may be contacted at:

Calgary Office
3rd Floor, 640 – 5th Avenue S.W.
Calgary Alberta T2P 3G4
Phone: 403-662-3990
Fax: 403-662-3994

Edmonton Office
4th Floor Sterling Place, 9940 – 106th Street
Edmonton, Alberta T5K 2N2
Phone: 780-422-1977
Fax: 780-427-0607

Fairview Office
Provincial Building
10209 – 109th Street
Box 159, Fairview Alberta T0H 1L0
Phone: 780-835-7111
Fax: 780-835-3259

Lethbridge Office
Agriculture Centre
100, 5401 – 1st Avenue S.
Lethbridge, Alberta T1J 4V6
Phone: 403-381-5166
Fax: 403-381-5806

Morinville Office
Room 201, Provincial Building
10008 – 107th Street
Morinville, Alberta T8R 1L3
Phone: 780-939-1212
Fax: 780-939-3194

Red Deer Office
Provincial Building
303, 4920 – 51st Street
Red Deer, Alberta T4N 6K8
Phone: 403-340-5241
Fax: 403-340-5599

4. **Atlas of Alberta Lakes** — Please see State of the Watershed Report Section: Water Quality.
5. **NEOS Library Consortium** — Please see the Libraries section.

Area History

1. **Atlas of Alberta Lakes** — please see State of the Watershed Report Section: Water Quality
2. **NEOS Library Consortium** — please see the Libraries section
3. **Google Search and/or Google Scholar** — please see the General Resources section
4. **Royal Alberta Museum** — please see the General Resources section

Biological Diversity

1. **Alberta Biodiversity Monitoring Institute**

What is available?

The Alberta Biodiversity Monitoring Institute (ABMI) conducts world-class monitoring of the changing state of Alberta's species, habitats, and ecosystems. More than 2000 species and habitats are tracked by the ABMI using remote sensing and field sampling protocols over a grid of 1656 sites distributed evenly throughout

the province. ABMI measures, representing a diversity of wildlife from both terrestrial and aquatic ecosystems, include a variety of terrestrial species, wetland species, species in lakes and rivers, terrestrial habitat, wetland habitat, landscape habitat, human footprint.

Survey results are available in either a raw data format or as a summarized information product specific to a particular area.

How can this information be used in a State of the Watershed Report?

Information on an area's biodiversity and the change over time in highly relevant species, habitats, and human land use activities, provides a measure of the overall health of the ecosystem encompassing your watershed. It should be noted that the sampling design of the ABMI monitoring program allows one to draw inference about the provincial and regional state of these indicators; as such, the information is applicable at the basin or watershed-scale (ie: WPAC-scale), but is likely not applicable at a subwatershed scale (WSG-scale).

How to obtain the information?

The ABMI's information products are made publicly available through a single web portal or via web services found at www.abmi.ca, and clicking on either the "**Biodiversity Browser**" or "**Raw Data**" tab from the menu options. Some ABMI reports may be available for distribution in hard copy.

The Biodiversity Browser (still being developed at the time of printing of this handbook) is considered the heart of the ABMI website in terms of online functionality, and will allow users to select management areas tailored to user needs (eg: individual watersheds). Summarized biodiversity reports will also be available for a number of predefined polygons (forest management areas, major watersheds, and natural regions/subregions).

Access to raw data (the only information access route available at the time of printing of this handbook) requires that the user create an on-line user account (there is no fee associated with creating an account or accessing any of the ABMI's information).

For further information, please contact:

Jim Herbers
Director, Information Centre
Alberta Biodiversity Monitoring Institute
CW-405, Biological Sciences Centre
University of Alberta
Edmonton, Alberta T6G 2E9
Phone: 780-492-5766
Email: **jherbers@ualberta.ca**

Climate and Meteorological Data

1. Meteorological Survey of Canada

What is available?

Meteorological Survey of Canada has records of climate variables such as rainfall and snowfall amounts, minimum and maximum temperatures and monthly, yearly and sometimes daily temperature records for many regions across the province. Some of these records date back to the 1800's.

How can this information be used in a State of the Watershed Report?

This data would be used to complete the climate section of the report. It will give an indication of annual and seasonal temperature, rainfall and snowfall variations, which can be used to establish correlation between water levels and climate.

How to obtain the information?

Navigate to the following website: http://www.climate.weatheroffice.ec.gc.ca/Welcome_e.html

Click on "Climate Data Online". Choose "Alberta" as the province of interest, then click on "Customized Search". This will take you to another webpage where you can set your specific search criteria, e.g. date range, proximity or station name. This will generate a list of results. Choose the information of interest and click on "Go" to open the report.

Alternately, click on "Climate Normals and Averages"; this will generate an alphabetical listing of all towns and cities with recorded climate information. Click on the town or city of interest (your exact town may not be listed, try to find the closest location). This will bring up a chart of all the relevant climate data that can then be printed or saved to disk. This provides at least 20 years of data.

For requests not found on the website, you can email Meteorological Survey of Canada at **Climate.Services@ec.gc.ca.** There can be some charges associated with specific requests, these are listed below:

Price for off-the-shelf CDs: $100 + $15 shipping + GST
Prices also apply for customized data sets from the client services units in various Environment Canada offices across Canada.
ISO images of the CDs are made available for download for free if you have high speed Internet access. With an ISO image you can create your own CD if you have the appropriate personal computer hardware and software. This notice applies to the CD-ROM image daily climate CDs for Eastern and Western Canada.
Contact information is as follows:

Edmonton Phone: 1-900-565-1111 (Fees of $2.99 per minute apply)
Fax: 780-495-3529
Email: **climate.prairie.north@ec.gc.ca**

Calgary Phone: 1-900-565-1111 (Fees of $2.99 per minute apply)
Fax: 403-292-5314
Email: **climate.prairie.north@ec.gc.ca**

Fish and Amphibian Populations

1. Alberta Fish and Wildlife — Sustainable Resource Development

What is available?

Results of fish and habitat surveys, reports on commercial fishing and fisheries management are available through website or through one of the Fish and Wildlife district offices. Data includes fish species, size and age distributions, records of fish kills and angler usage rates of particular lakes. There is also information on amphibian populations in Alberta, amphibian distribution, biology and habitat and monitoring programs.

How can this be used in the State of the Watershed Report?

Information about fish and amphibian species and habitat will identify species present, their status and/or any regulations concerning the species. If there is data available from several years it may be possible to determine the changes in fish populations and habitats over time. Information may identify historical species that were present and/or past spawning/breeding locations. This can all be used together to determine appropriate management strategies and restoration efforts.

How to obtain this information?

Visit the Alberta fish and Wildlife — Fishing in Alberta website: http://www.srd.gov.ab.ca/fishwildlife/fishingalberta/default.aspx

Here you can browse the 'Fishing News' section to see if there are any changes in regulations or special exceptions (i.e. special walleye licenses). You can also view 'Fish Management Issues' in Alberta. This section includes reports on Fish stocking, status of Alberta fish and conservation strategies.

Also available is information on The Instream Flow Needs Program: http://www.srd.gov.ab.ca/fishwildlife/fishingalberta/instreamflowneedsprogram.aspx

This program outlines how to protect or restore fish and wildlife habitat that depends on water flow. By considering the program's science-based guidelines, natural resource managers can protect fish and wildlife populations from the direct impacts of water flow changes caused by humans. Current Instream Flow Needs Projects are as follows:

South Saskatchewan River
Highwood River
North Saskatchewan River
Lesser Slave River
Lesser Slave Lake
Athabasca River

Information on Amphibian populations, habitat, biology and distribution can be found at: http://www.srd.gov.ab.ca/fishwildlife/wildlifeinalberta/amphibiansalberta/default.aspx.

For more information on your specific watershed you can contact a Fish and Wildlife office near you. A list of offices can be found at: http://www.srd.gov.ab.ca/informationcentre/offices.aspx. As well, there is a

provincial Fisheries Management Area Contacts map available in which the local Fisheries staff members are identified, and their contact information provided. The map is in PDF format and can be found at: http://www.srd.gov.ab.ca/fishwildlife/guidelinesresearch/managementareacontacts.aspx.

2. **Department of Fisheries and Oceans Canada (DFO)**

What is available?

Reports on fish, fish habitat, public and commercial fisheries on lakes and rivers are available online or through the Eric Marshall Aquatic Research Library. Not all watersheds and waterbodies will have information available.

How can this be used in the State of the Watershed Report?

Information about fish species and fish habitat will identify species present, their status and/or any regulations concerning the species. If there is data available from several years it may be possible to determine the changes in fish populations and habitats over time. Information may identify historical species that were present and/or past spawning locations. This can all be used together to determine appropriate management strategies and restoration efforts.

How to obtain this information?

To obtain publications from the Eric Marshall Aquatic Library please see the Libraries Section.

3. **Alberta Conservation Association** — please see **State of the Watershed Report Section: Wildlife and Species at Risk**.

Geology, Topography and Soils

1. **Alberta Geological Survey**

What is available?

The Alberta Geological Survey library is an excellent resource for geoscience information and is available to government agencies, industry, students and members of the public. Their collection includes all Alberta Geological Survey documents, federal and provincial geological surveys and maps.

The Alberta Geological Survey website contains an archive of reports and other publications that are available for purchase, as well as a full library of resources that may be borrowed. The website archive contains information that may be used in a State of the watershed report such as maps, hydrology reports, mineral extraction operations, groundwater assessments and other information relating to the oil and gas industry (coal bed methane, oil and gas well sites, etc.).

A complete set of digitized lake bathymetry (ie: depth) maps is also available for download. There are 3 datasets for each of 169 lakes: shoreline contours, bathymetry contours, and ASCII lakebed grids. These are shapefiles so you will need to a GIS platform to view them in.

How can this information be used in a State of the Watershed Report?

This information can be useful in a State of the Watershed report as it will provide soil and rock types, which can affect water quality and land use; resource availability, such as oil and gas, which will give an indication of present and future land use, water usage requirements and water quality impacts.

How to obtain the information?

AGS website publications may be found at:

http://www.ags.gov.ab.ca/publications/publications_alberta_geological_survey.shtml

Some reports are available for free, while others have an associated charge. Once you have found a publication that pertains to your project, look to the right-hand side of the page; if it says "View PDF", the entire document may be downloaded for free. Free reports require WinZip for zipped files or Adobe Reader 7. There is a link at the bottom of this page that will allow you to download the Adobe Reader program, which is free. If it does not say this, click on the title and a new window will open, in which the cost of purchase will be displayed.

Purchases can be made by contacting:

Alberta Geological Survey
4th Floor, Twin Atria Building
4999 – 98 Avenue
Edmonton, Alberta T6B 2X3

Information Centre
Phone: 780-422-1927
Fax: 780-422-1918
Email: **EUB.AGS-Infosales@gov.ab.ca**

Interactive maps of the geology of Alberta hydrogeology/water well chemistry, Radarsat-1 holdings, sand and gravel and coal bed methane potential sites may be obtained. These GIS maps can be found on:
http://www.ags.gov.ab.ca/GIS/gis_and_mapping.shtml

Shape files are available, which require a free ArcExplorer viewer; there is a link to the free viewer download site provided.

Surficial maps can be found on:

http://www.ags.gov.ab.ca/activities/surficial_mapping/surficial_mapping.html

Clicking on a map unit will produce a listing of all related maps for that area. A listing of related surficial mapping publications can be found on:

http://www.ags.gov.ab.ca/activities/surficial_mapping/surficial_publications.html

The AGS library catalogue can be found at:

http://www.ags.gov.ab.ca/library/library_alberta_geological_survey.shtml

Once on this page, click on "Search Library Catalogue" to access the information. This will bring you to the NEOS Library Consortium Catalogue. The AGS library is a partner in the NEOS Consortium (see "Libraries" section for more information). In order to borrow materials, you must have a valid Alberta library card.

Contact information for the library is as follows:

Linda White
Energy Resources Conservation Board
Alberta Geological Survey
402, 4999 – 98th Avenue
Edmonton, Alberta T6B 2X3
Direct Line: 780-422-1685
AGS Information Centre: 780-422-1927
Fax: 780-422-1918
Email: **EUB.AGS-library@eub.ca**

2. Alberta Soil Information Viewer (Alberta Agriculture and Food)

What is available?

The Alberta soil Information Viewer, hosted by Alberta Agriculture and Food is a free internet viewer that allows the user to view and query soils information in AGRASID Version 3.0 (Agricultural Region of Alberta Soil Inventory Database).

How can this information be used in a State of the Watershed Report?

This information can be used useful for a State of the Watershed Report as it will help to identify the types of soils present in a watershed which can affect surface and groundwater water quality. This information can be used in the development of recommendations and best management practices.

How to obtain the information?

The Soil Information Viewer can be found at:
http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag10372

To use the viewer:

1. 1. Click on the "Online Soil Viewer" link located at the left side of the webpage. A separate web page will open. If your computer does not allow pop-ups you will have to enable pop-ups from this site in order to use the Viewer.
2. To locate your watershed click on the "Find Location" tab or the "Find Township" tab at the top of the page. If you chose the first option, a list of option will appear at the right hand side of the page. You can select either latitude/ longitude coordinate or UTM coordinate. Enter in the appropriate coordinates. If you chose the latter option, enter in the appropriate township, range and meridian.
3. Once the map has appeared, you can zoom in or zoom out by selecting the  or  buttons. You can select the  button and click and drag the map to the exact location you are interested in.

4. To view a soil profile, select the ℹ icon (located above the map), then click on a polygon of interest. The information will appear to the right of the map.

For help and more information on the viewer you can select "Soil Viewer Help" located on the main page.
For more information about the soil viewer content please contact:
David Spiess
Resource Data Engineer
Phone: 780-427-3739
Email: **david.spiess@gov.ab.ca**

3. Canadian Soil Information system (CanSIS)

What is available?

Detailed soil survey reports and maps are available for various areas across Canada. Surveys are available to download from the website.

How can this information be used in a State of the Watershed Report?

This information can be used useful for a State of the Watershed Report as it will help to identify the types of soils present in a watershed which can affect surface and groundwater water quality. The type of soils present can also be used to help determine risk of groundwater contamination.

How can this information be obtained?

To obtain soil surveys of Alberta go to: http://res.agr.ca/cansis/publications/ab/index.html. A listing of map sheets will appear. After you have selected the soil survey of interest you can choose to view or download the report. You can also download a map of the area.

4. AESA Soil Quality Resource Monitoring

What is available?

The purpose of the AESA Soil Quality Resource Monitoring Program is to monitor soil quality and develop projects to help understand and conserve soil quality in Alberta. The program maintains a balance of monitoring, risk assessment, science development and extension. The program has 44 benchmark sites across the province for soil quality and yield of grain or forage, soil fertility and bulk density are sampled and measured annually.

How can this information be used in a State of the Watershed Report?

This information can give an idea of what areas are sensitive to erosion, which have good or poor growing potential, and the potential effect of substrate composition on surface and groundwater quality. This can assist with land use planning recommendations. An assessment of phosphorus levels in the benchmark sites is available as well, which can be useful in the event of a eutrophic site of interest that experiences algal blooms.

How to obtain the information?

A report on the preliminary results of the 5 years of sampling can be found at:

http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/aesa8423?opendocument

The phosphorus assessment findings can be found at:

http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/aesa8426/$FILE/8426.pdf

For any further inquiries please contact:

Jason Cathcart
Soil Conservation Specialist/AESA Soil Quality Coordinator
Alberta Agriculture and Rural Development
206 J.G. O'Donoghue Building
7000 – 113 Street
Edmonton, Alberta T6H 5T6
Phone: 780-427-3432
Fax: 780-422-0474
Email: **Jason.cathcart@gov.ab.ca**

5. **NEOS Consortium** — Please see the Libraries section.

Groundwater Resources

1. **Agriculture and Agri-Food Canada**

What is available?

Agriculture and Agri-Food Canada and Prairie Farm Rehabilitation Administration have partnered to fund regional groundwater assessment studies that contain updated digital maps showing the groundwater development potential of potable water aquifers that underlie a municipality. These new groundwater studies provide an overview of the groundwater resources and characteristics in individual municipalities. Shallow and deep aquifers are identified and potential yield and water quality are characterized.

The website has a complete listing of all groundwater assessment reports available for Alberta. There is a map of the province that shows where assessments have been completed, where they are in progress, and where they are missing. The reports themselves are then listed in alphabetical order by County name.

How can this information be used in a State of the Watershed Report?

The regional groundwater assessments provide updated information that helps users determine the status of the groundwater resource in an area and what steps should be taken to best manage the resource. They also can be used to help identify constraints to and opportunities for rural economic development.

How to obtain the information?

The reports are available in PDF format for free download on:

http://www.agr.gc.ca/pfra/water/groundw_e.htm

The reports are quite large and have been divided into sections; all sections must be downloaded in order to obtain the complete report. Clicking on the small hyperlinks below the County name will automatically open the PDF document.

A CD version of a specific report may be ordered through the Alberta Geological Survey for a cost of $20, the contact information is:

Information Sales
Phone: 780-422-1927
Email: **info.sales@eub.ca**

AAFC/PFRA contacts include:

Bunny Mah
Provincial Ag-water Manager
Room 600, 138 – 4th Ave SE
Calgary, Alberta T2G 4Z6
Phone: 403-292-4972
Fax: 403-292-5659
Email: **mahb@agr.gc.ca**

Terry Dash
Provincial Technical Director
Room 600, 138 – 4th Ave SE
Calgary, Alberta T2G 4Z6
Phone: 403-292-5719
Fax: 403-292-5659
Email: **dasht@agr.gc.ca**

2. Alberta Environment — Groundwater Information System

What is available?

The Groundwater Information System is a database that contains approximately 500,000 drilling records. Information about individual water well drilling reports, chemical analysis reports up to the end of 1986, springs, flowing shot holes, test holes and pump tests conducted on the wells are available. Through this system you can view the information from the original report received by the Groundwater Information Centre. You will also be able to print the individual records plus print the overlaying map(s) that show the wells in relation to other wells and roads, etc.

How can this information be used in a State of the Watershed Report?

The Groundwater Information Systems can be used to determine the approximate number of wells (past and present) located in a watershed. Chemical analysis reports for wells may be used for determination of groundwater depth and quality in the area.

How to obtain the information?

Go to http://environment.alberta.ca/1295.html

1. Click on the link 'Groundwater Information System' located at the bottom of the page. A new page will open (Ensure that pop-ups are enabled).
2. Click on the 'Find Water Wells' tab located at the top right of the page. Click on the 'Legal Location' or 'Go to Municipality' link.
3. If you chose Legal location, enter the section, township, range and meridian that you wish to search for into the appropriate boxes. Click the SUBMIT button. If you chose 'Go to Municipality' type in the name of the county or municipality you would like to search for then press the SUBMIT button.
4. The map will zoom into the location you have selected.
   a. If you used the Legal Location search a list of well found in the section will appear at the bottom right of the page. To view the drilling report of a particular well, click on the GO button (this will select the well) then click on 'Water Well Drilling Report' link, found above the list of wells.
   b. If you chose the municipality search, you will need to click the GO button next the municipality you would like to view. Then using the  function, select a particular well by clicking and dragging the arrow across the blue circle (indicating well location). Click on 'Water Well Drilling Report' link, found above the list of wells.

      There is a 'Help' tab at the top right corner of the page if you require further explanation of the Groundwater Information System.

      There are some items in the Groundwater Database that are not viewable i.e. geophysical logs, new reports received that have not yet been entered into the database. If you require this information or have any other questions you can contact Alberta Environment's Groundwater Information Centre (GIC) by sending an email, **gwinfo@gov.ab.ca**, faxing 780-427-1214 or phoning 780-427-2770.

A direct contact is:

Jeannette Homeniuk
Groundwater Data Technologist
Alberta Environment
11th Floor Oxbridge Place
9820 – 106 Street
Edmonton, Alberta T5K 2J6
Phone: 780-427-9595
Fax: 780-427-1214
Email: **jeannette.homeniuk@gov.ab.ca**

To obtain chemical analysis information after 1986 contact your regional health authority.

3. Alberta Environment — Groundwater Observation Well Network

What is available?

The Groundwater Observation Well Network (GOWN) is a network of groundwater wells that monitor groundwater levels in aquifers across Alberta. Some wells in the network also monitor a variety of groundwater quality parameters. You can access the historical groundwater level information for the active wells in the network.

How can this information be used in a State of the Watershed Report?

GOWN can be used to determine the approximate groundwater levels in a watershed. Chemical analysis reports for wells may be used for determination of groundwater depth and quality in the area. Groundwater interacts with surface water via discharge and recharge areas. This information can be used to help determine best management practices for a watershed.

How to obtain this information?

Visit the GOWN website at: http://environment.alberta.ca/apps/GOWN/Default.aspx

If you do not know the name or number of active well in your area click on the link to the map of active well, found at the bottom of the page. Locate the well(s) in your watershed (if any). There are buttons at the bottom left corner of the map where you can choose to show shallow, intermediate or deep wells. Once you have located a well of interest use the curser to click on the well. This will bring up information about that well.

For more information contact your local Alberta Environment office (see listing below) or dial 310-0000.

Northern Region
Twin Atria Building
#111, 4999 – 98 Avenue
Edmonton, Alberta T6B 2X3
Phone: 780-427-7617
Fax: 780-427-7824

Central Region
#304, Provincial Building
4920 – 51 Street
Red Deer, Alberta T4N 6K8
Phone: 403-340-7052
Fax: 403-340-5022

Southern Region
#303 Deerfoot Square Building
2938 11 Street, N.E.
Calgary, Alberta T2E 7L7
Phone: 403-297-7602
Fax: 403-297-6069

Water Management Operations
Second floor, Provincial Building
200 – 5 Avenue South
Lethbridge, Alberta T1J 4L1
Phone: 403-381-5300
Fax: 403-381-5969

4. **Groundwater Centre**

What is available?

The Groundwater Center is a website that contains groundwater information from across the province that cannot be obtained through government or private organizations. The data is mainly from Western Canada and some portions of the northwestern United States. The Groundwater Center also has all of the groundwater Assessments available from the PFRA website.

How can this information be used in a State of the Watershed Report?

This can be used to supplement any data that has been obtained from reports or government agencies. Groundwater data is typically scarce so it is best to try all sources possible to obtain information about groundwater quality, amounts, depths, etc. This can help identify any areas of groundwater sensitivity that should be protected and can give an estimate of the amount of groundwater available for use either by wells or other uses.

How to obtain the information?

Navigate to http://www.groundwatercentre.com/Default.asp?bhcp=1

Click on "Data" at the top of the page. A membership is required to access the information, but the membership is free. If you click on any of the data types you will be directed to a page where you must enter in your email address and password. Click on "become one", which is a link that will take you to a page where you must enter in your personal information, such as name and email address. You must then choose a password and click "Join". Once that is completed, you will be directed back to the main page. Click on "Data" once again, and then choose the topic of interest. You will likely be asked to enter the legal land description for your site of interest (e.g. SW-24-9-16-W4M). Be sure to have this information handy.

Telephone enquiries can be made at 1-800-GEO-WELL or through **support@tgwc.ca**.

5. **Regional Health Authority** — For data after 1986 — Please see State of the Watershed Report Section: Water Quality

Land Use Bylaws and Area Structure Plans

1. **County or Municipality**

What is available?

Land use bylaws and area structure plans may be obtained by contacting the county or municipality your watershed is located in. The documents outline how the land is to be partitioned and used within a municipality.

How can this information be used in a State of the Watershed Report?

Land use plans within a watershed can give indications of how water resources will be affected due to past and present development, as well as if there will be land set aside for environmental reserve, municipal reserve or other uses. Area structure plans and land use bylaws may be altered or adapted during the Watershed Management Planning phase.

How to obtain the information?

Doing a simple Google search for your county/municipality should take you to a municipal website with contact information. Watersheds do not follow municipal boundaries; it may be necessary to contact two or more municipalities and obtain their planning documents separately. On some occasions land use bylaws and area structure plans are posted directly on the website for the municipality; if this is not the case, contacting the municipal office and asking for the planning department should assist you in the search. Occasionally a written request via fax is required, specifying what documents are being sought and what they will be used for, other times a simple verbal request over the phone will suffice. A charge may be accompanied if reproduction is required.

A complete listing of all municipalities, First Nations, towns, villages, etc., can be found at:
http://www.municipalaffairs.gov.ab.ca/mc_municipal_officials_search.cfm
This directory can be downloaded in Word or Excel format and is updated regularly.

Maps, Aerial Photos and Watershed Delineation

2. Sustainable Resource Development — Lands Division

What is available?

The Sustainable Resource Development — Lands Division, Air Photo Distribution has aerial photos available for purchase. They have a collection of over 1.4 million aerial photographs covering the entire province of Alberta dating back to 1949. Medium or small scale black & white and colour photography are available for viewing in the Reference Library. Copies of the photography can be purchased either in hard copies or digital formats.

How can this information be used in a State of the Watershed Report?

Aerial photos are useful to a State of the Watershed Report because they can be used to determine land use and land cover within the watershed. If there are maps available for a number of years for a particular watershed they can be used to determine change in land use, land cover, extent of deforestation and/or changes in water levels.

How to obtain the information?

1. The best way to obtain air photos is to visit the Air Photo distribution Center located in Edmonton. You must bring with you the legal land description and the staff will show you what is available for the area.

   Air Photo Distribution
   9920 – 108 Street, Main Floor
   Edmonton, Alberta T5K 2M4
   Phone: 780-427-3520
   Fax: 780-422-9683
   Email: **Air.Photo@gov.ab.ca**

   Public Hours: 9:0am – 4:30pm Monday – Friday

2. If you are unable to visit the Air Photo Distribution Center, you can search online using the external Aerial Photo Record System (APRS) website: https://securexnet.env.gov.ab.ca/aprs/index.html
   a. Click on the APRS Search link to enter the search page. Unless you hold an account, you will need to log-in as a guest (**User: Guest**, and **Password:Guest**). Once on the search page enter the legal land description. You must enter the Sec. Twp. Rge. W Meridian (e.g. 8-50-16-5).
   b. Click on Submit Query button, located directly below legal land description entry box.
   c. Click on the highlighted projects to download a zip file containing the flight index maps for the project. The downloaded ReadMe file provides instructions on how to identify the roll and frame numbers for the photo being requested.
   d. Once you have selected the project, roll, and frame numbers, record these numbers, return to the original search page, click on link titled **Aerial Photo Services Homepage**, then from the menu bar on the left side of the screen, click Ordering Products. Otherwise go directly to the SRD — Ordering Products Page at http://www.srd.gov.ab.ca/lands/geographicinformation/airphoto/orderingproducts.aspx
   e. Click on the link to an order form, located at the bottom of the page. The order form is available as a Word document and PDF. Download this form, print and fill out. When ordering, you must provide the **required project numbers** and a **more precise location** (i.e. site diagram, quarter section, legal subdivision or street address). Send this order form to the Air Photo Distribution Center (address listed above).

If you need assistance with the APRS website or the ordering process you can contact **the Air Photo Distribution Center** (listed above).

2. Agriculture and Agri-Food Canada

What is available?

The Canadian Land Resource Network and its predecessors have printed thousands of maps about Canadian soils, landscapes, land use and climate. Some of these maps have been scanned and are available online, others are available from CanSIS.

How can this information be used in a State of the Watershed Report?

Soils maps can be useful in determining appropriate land use types, areas that may be sensitive to groundwater contamination, regional climate and other information. This can be useful in the development of recommendations and best management practices.

How to obtain this information?

A variety of maps and geospatial data (including land cover, watershed boundaries, etc) are available from http://www.agr.gc.ca/nlwis-snite/index_e.cfm?page=intro . The maps allows the user to access interactive maps featuring a number of applications, including a suite of agri-environmental indicators compiled from national agricultural census data.

Visit the following website to view and download maps of Terrestrial Ecozones, Ecoregions and Ecodistricts of Manitoba, Saskatchewan, Alberta: http://res.agr.ca/cansis/publications/maps.html. From this site, you can also search query the full inventory of printed publications holdings of CanSIS. To search for maps of Alberta go to: http://res.agr.ca/cansis/nsdb/meta/query_all.html. Type 'Alberta' in the search box under the 'Query by Map Name' section.

These maps can be obtained from CanSIS by contacting:

Peter H. Schut
Agriculture and Agri-Food Canada (AAFC)
Rm. 1135, Neatby Bldg.
960 Carling Avenue
Ottawa, Ontario K1A 0C6
Voice: 613-759-1874
FAX: 613-759-1937
Email: **schutp@agr.gc.ca**

3. **PFRA** — See State of the Watershed Report Section: Agricultural Activity.

Provincial, Federal and Municipal Legislation

1. Queen's Printer

What is available?

The Queen's Printer is the source of all print and electronic versions of government legislation, acts, Codes of Practice, manuals and surveys. This does not include all department publications, as most of those are available on the individual department websites. The Queen's Printer will have the Municipal Government Act, the Environmental Protection and Enhancement Act, the Provincial Water Act, the Fisheries (Alberta) Act and many others.

How can this information be used in a State of the Watershed Report?

The government acts and legislation will assist with the development of recommendations that may be included in a State of the Watershed report, and will provide legal guidance on exactly who is responsible for certain land types, what enforcement options are available, what constitutes an environmental violation, and many other topics.

How to obtain the information?

The Queen's Printer website is: http://www.qp.gov.ab.ca/index.cfm

Many documents can be viewed online but are not downloadable or in a printable format. The vast majority of the documents must be ordered and have an associated cost, which varies according to the document format and size.

Documents may be ordered online by accessing the Catalogue page: http://www.qp.gov.ab.ca/catalogue/

Once you have selected the document of interest, click on "Ship Product" and it will be added to your virtual shopping cart. Once you have selected all the documents you wish to purchase, you can go to the "checkout" page and follow the instructions for payment. Some documents can be downloaded after payment is received and some will be shipped in paper or CD format. Shipping charges are included in the cost.

To order by phone or in person, the bookstore locations and phone numbers are:

Edmonton Bookstore
Main Floor, Park Plaza
10611 – 98th Avenue
Edmonton, Alberta T5K 2P7
Phone: 780-427-4952
Fax: 780-452-0668

Publications that were published prior to 1995 can be found at:

Alberta Legislature Library
216 Legislature Building
10800 – 97 Avenue
Edmonton, Alberta T5K 2B6
Phone: 780-427-2473
Fax: 780-427-6016
Email: library@assembly.ab.ca

Public Surveys

1. **NEOS Library Consortium** — Please see the Libraries section.
2. **Local Watershed Stewardship Group** — Contact the local watershed stewardship group in your area.
3. **County or Municipality** — Please see State of the Watershed Report Section: Land Use Bylaws and Area Structure Plans.

Resource Exploration and Linear Disturbances

1. **Energy Resources Conservation Board**

   What is available?

   The ERCB has many reports and maps related to the oil and gas industry in Alberta. Many are of a technical nature but there are maps of pipelines and geological studies from regions across the province.

How can this information be used in a State of the Watershed Report?

This information can be useful in determining the extent of oil and gas development in your area of interest, the location of pipelines and the potential for further drilling or development. This can assist with land use planning recommendations and best management practices for protection of groundwater and surface water resources.

How to obtain the information?

The ERCB website is located at:

http://www.ercb.ca/portal/server.pt?open=512&objID=265&PageID=0&cached=true&mode=2

From this page, an entire list of publications is available for download in PDF format. You can also click on "Publications Available" and this will direct you to a list of publications by topic area. Clicking on the topic of interest will display the list of applicable publications. There may be a charge associated with some of the publications; others will be available free of charge.

In order to contact the ERCB, you can call their Customer Contact Center at 403-297-8311 from 8:00am – 4:30pm or by email at **Inquiries@ercb.ca** . Alternatively, a listing of the various offices around the province can be found at:

http://www.ercb.ca/portal/server.pt/gateway/PTARGS_0_0_301_262_0_43/http%3B/ercbContent/publishedcontent/publish/ercb_home/about_the_ercb/contact_information/offices.aspx

Field offices can be found at:

http://www.ercb.ca/portal/server.pt/gateway/PTARGS_0_0_301_262_0_43/http%3B/ercbContent/publishedcontent/publish/ercb_home/about_the_ercb/contact_information/field.aspx

There is also a list of contacts available by subject at:

http://www.ercb.ca/portal/server.pt/gateway/PTARGS_0_0_301_262_0_43/http%3B/ercbContent/publishedcontent/publish/ercb_home/about_the_ercb/contact_information/subject.aspx

2. Abacus Datagraphics

What is available?

Abacus has many maps available showing buried utility lines, oil and gas wells, facilities, spills, water wells and mineral rights. Aerial photos are also available.

How can this information be used in a State of the Watershed Report?

This information can be useful in determining the extent of oil and gas development in your area of interest, the location of pipelines and the potential for further drilling or development. This can assist with land use planning recommendations and best management practices for protection of groundwater and surface water resources.

How to obtain the information?

Abacus requires a membership with an associated membership fee. A free trial is available at:

http://www.abacusdatagraphics.com/AbaData/mgMain.asp

It is best to read the User Manual, available for download in PDF format on that same webpage. Use of this site will also require downloading 1 or 2 specific map viewer programs, the links to which are posted on the website. There is also a minimal charge for each download.

3. **National Pollutant Resource Inventory (NPRI)**

What is available?

NPRI is Canada's publicly accessible inventory of released, disposed of and recycled pollutants. You are able to search for pollutant release data via a map powered by Google Earth. From there you are able to determine the date of the release, who was responsible, what was released and how much. Industrial, institutional and commercial facilities which meet NPRI **reporting requirements** are required to report under the Canadian Environmental Protection Act, 1999 (CEPA 1999).

How can this information be used in a State of the Watershed Report?

This information can be used to determine if there have been any pollutants released within the watershed of interest. You can find out how much was released, when and if it was released into the air, water or onto land. The information may be used to determine potential source(s) of water and/or groundwater contamination.

How to obtain the information?

Go to the NPRI website: http://www.ec.gc.ca/pdb/npri/npri_google_earth_e.cfm

Under "Download Map Layers" click on 'By province/territory — NPRI_Prov_2006_e.kmz' or 'By selected sectors — NPRI_Sector_2006_e.kmz'

You will need to save the file to your computer to gain access to the data. For more information on how to use the application you can click "**How to view NPRI information for 2006 using Google Earth™**"

4. **NEOS Library Consortium** — Please see the Libraries section.

Riparian Areas and Wetlands

1. Cows and Fish (Alberta Riparian Habitat Management Society)

What is available?

Cows and Fish has been working on riparian areas in Alberta since 1992. They have conducted riparian health evaluations in many watersheds across the province, mostly as part of community-based initiatives. Riparian health inventory is the most common method of riparian health evaluation used by Cows and Fish for watershed scale assessment. A rapid survey (or short form assessment) is also used when detailed information is not necessary. This is a service available to watershed stewardship groups, including WPACs, on a cost share basis, by making a request to Cows and Fish. They recommend awareness, education and field tours as part of such an initiative, and these are generally minimal or no-cost.

How can this information be used in a State of the Watershed Report?

Riparian health evaluation can be extremely useful in the development of recommendations and best management practices pertaining to riparian areas. Riparian health inventory and assessment both identify concerns, if any, within riparian areas including invasive plants, erosion and others. They can also identify which areas are healthy and functioning and should be protected or maintained. The Cows and Fish approach to riparian health evaluation is part of a process that includes awareness and landowner contact combined with on-the-ground data collection and monitoring to build ownership of the issues surrounding riparian areas in local watersheds.

How to obtain the information?

Cows and Fish does not post riparian assessment or inventory information on their website; you must contact them to determine if any information is available for your watershed. Cows and Fish cannot release any data without prior permission from the group or individual for which it was collected. You may also request that a riparian health evaluation be undertaken within your watershed, if one has not previously been conducted.

For further information, you may contact:

Program Manager
Norine Ambrose
2nd Floor, YPM Place
530 – 8th Street South
Lethbridge, Alberta T1J 2J8
Phone: 403-381-5538
Fax: 403-381-5723
Email: **nambrose@cowsandfish.org**

Additional contacts can be found at http://www.cowsandfish.org/contacts.html.

2. SRD — Riparian Land Management Unit

What is available?

SRD has piloted a Shoreline Management Program in the Woodlands region in 2007. They are currently collecting data on use of the shoreline (by shoreline ownership parcels) around recreational lakes. This information is then mapped on GIS. This information serves to establish knowledge bases as to state of the shoreline at this time. Shoreline assessments of recreational lakes in other regions of the province are expected to begin in 2008.

SRD is also currently mapping all PNTs (protective notations) where have restricted activity/development areas.

How can this information be used in a State of the Watershed Report?

This information would be extremely useful in the development of recommendations and best management practices pertaining to riparian areas. It will give you an idea of what sort of problems are present in your riparian zones, from invasive plants to erosion and many other concerns.

How to obtain this information?

Contact:
Gerry Haekel
Head, Riparian Land Management & Water Boundaries Unit
Land Management Branch, Lands Division
Alberta Sustainable Resource Development
3rd Floor, South Petroleum Plaza
9915 – 108 Street
Edmonton, Alberta T5K 2G8
Phone: 780-427-4767
Fax: 780-422-4251
Email: **gerry.haekel@gov.ab.ca**

3. SRD — Alberta Wetland Inventory

What is available?

There has been a wetland inventory completed for the Vermilion River, Moose Lake, and Iron Creek watersheds. The wetland inventory utilizes historic and current aerial photography to characterize the abundance, distribution, and condition of the watershed's wetland resources. This multi-temporal approach provides the ability to constantly define basins that are in either a cultivated, drained or intact state; accurately determine the magnitude of wetland loss; and identify wetland restoration potential.

How can this information be used in a State of the Watershed Report?

This dataset combines all of the basin impact classes (Currently Drained Altered, Currently Drained Consolidated, Currently Drained Lost, Historically Drained Altered, Historically Drained Consolidated, Historically Drained Lost, Intact, Lost). This will assist in land use recommendations and identification of critical wetlands for preservation of water quality.

How to obtain this information?

To view the wetland inventory findings for the Vermilion River watershed, visit the Ducks Unlimited Canada (DUC) website: **http://www.ducks.ca/province/ab/how/research/inventory/**. On the right side of the page, below Related Links, click on the link 'View an example of the provincial wetland inventory'. An internet map server, with a variety of mapping tools and options, will open for the Vermilion River Watershed.

Note: Datasets for Moose Lake and Iron Creek watersheds are presently only available for internal Government of Alberta use. The general public will soon be able to view these data sets via the Ducks Unlimited Canada website listed above.

Hardcopy wall maps of these wetlands are available. For public access to these maps, the public should contact the Alberta Environment Information Centre: http://environment.gov.ab.ca/info/home.asp . Website: http://srd.alberta.ca/lands/geographicinformation/resourcedataproductcatalogue/default.aspx

Forward all requests for digital data to: **SRD.Data@gov.ab.ca**
Information regarding access to Map Products is available at: http://srd.alberta.ca/informationcentre/mapdistributioncentre.aspx

4. **Alberta Conservation Association** — Please see State of the Watershed Section: Wildlife and Species at Risk.
5. **Ducks Unlimited** — Please see State of the Watershed Section: Waterfowl Presence and Habitat.
6. **NEOS Library Consortium** — Please see the Libraries section.

Sediment Quality and Composition

1. **NEOS Library Consortium** — Please see the Libraries section.
2. **Google Search/ Google Scholar** — Please see the General Resources section.
3. **Water Survey of Canada** — Please see State of the Watershed Report Section: Water Quantity and Allocations.

Vegetation

1. **Alberta Natural Heritage Information Center**

What is available?

The centre provides accurate and accessible biodiversity information necessary for making informed decisions concerning conservation, natural resource management, and development planning. The ANHIC collects, continually updates, analyzes and disseminates information about the location, condition, status, and trends of selected elements, including species and plant communities.
Species information in the system for selected taxa includes the scientific name, taxonomy, geographic range, confirmed locations, population size and condition, global and subnational status, and autecology. Community information for selected communities includes classification, species composition, geographic range and location, endangerment status, and condition. Site information includes ownership, size,

boundaries, use classification, management status, and species and community occurrences. The databases are linked to a common bibliographic database and can be tied to a computerized Geographic Information System (GIS) for spatial display and analysis.

How can this information be used in a State of the Watershed Report?

This information can be used to identify any rare or endangered plant species within your area of interest. The GIS capabilities allows the generation of maps that could be included within the report.

How to obtain the information?

The ANHIC website is located at: http://tprc.alberta.ca/parks/heritageinfocentre/default.aspx

There are links on the left hand side of the page to topics such as lichens, plants, natural areas, protected areas and others. The contact information is as follows:

Alberta Natural Heritage Information Centre
Alberta Tourism, Parks, Recreation and Culture
2nd Floor, Oxbridge Place
9820 – 106 Street
Edmonton, Alberta T5K 2J6
Phone: 780-427-5209
Fax: 780-427-5980
Coordinator: John Rintoul
Email: **John.Rintoul@gov.ab.ca**

2. **Atlas of Alberta Lakes** — Please see the General Resources section
3. **NEOS Library Consortium** — Please see the Libraries section
4. **Google scholar** — Please see the General Resources section

Water Quality (including chemistry, biological and bacteria/parasites)

1. The Alberta Lake Management Society (ALMS)

What is available?

The Alberta Lake Management Society has an ongoing project called LakeWatch, in which many different lakes across the provinces are tested for basic water quality parameters on an annual basis over the summer months. LakeWatch technicians are trained by Alberta Environment staff on how to complete proper water quality testing. The results are compiled at the end of the testing season and a report is completed for each lake by the limnologists and water quality experts involved with ALMS. These reports are available free of charge from the ALMS website and in some cases many lakes have been tested over a multi-year period, so water quality data may extend back 3 to 4 years.

How can this information be used in a State of the Watershed Report?

This information can be used to augment other water quality data collected by other groups and/or government agencies.

How to obtain the information?

The reports are available in PDF format, and are listed in alphabetical order on the following web page:

http://www.alms.ca/content.php?content=1#REPORT

ALMS' contact information is:

ALMS Program Manager
P.O. Box 4283,
Edmonton, Alberta T6E 4T3
Phone: 780-702-ALMS (2567)
Fax: 501-423-6381
www.ALMS.ca

2. Alberta Environment (AENV)

What is available?

Alberta Environment performs water quality monitoring on many lakes, rivers, wetlands and streams in Alberta, and has historical data on waterbodies that have since been removed from the monitoring program, as well as monitoring done as a part of industrial approvals, contract monitoring and Alberta Environment inspector sampled data. The website has figures listing the trophic status of various Alberta lakes, river flow data, water supply forecasts, flood risk maps, groundwater information and approvals and licenses.

Note: For most samples, organic, inorganic, and metals analyses are available. Parameters monitored at continuous monitoring stations are limited to pH, alkalinity, dissolved oxygen, conductance, and temperature.

There are links to pages containing information regarding drinking water quality in various communities across the province and a listing of all currently and historically issued advisories and warnings. Rainfall and temperature data can also be found. Alberta Agriculture and Food/AESA river monitoring network data can also be obtained from Alberta Environment, as well as EPCOR water quality data for the City of Edmonton drinking water supply (Devon to Fort Saskatchewan).

How can this information be used in a State of the Watershed Report?

This information can be used to augment other water quality data collected by other groups and/or agencies. It can be used to determine how the status of a lake in question compares to other lakes in the province and can provide information regarding surface and ground water supply volumes. Any water use licenses or approvals that have been issued in the watershed of interest will be available for public viewing.

How to obtain the information?

The main information page listing all of the available water quality data can be found at: http://environment.alberta.ca/2013.html

The information is free of charge.

Simply click on the links under the topic heading of interest. For surface water quality data, click on "**Online Surface Water Quality Reports**" which will take you to a new page. This page will give the option of selecting the **"Inventory of Sampling Locations and Water Quality Data"**, "**Lake Water Quality Data**", "**Trophic State of Alberta Lakes**", or the "**River Network Water Quality Data**".

Clicking on **"Inventory of Sampling Locations and Water Quality Data"** will bring up two lists and two search boxes. For a general search, you can type in "*lake name*", (e.g. *Pigeon Lake*), and this will bring up all reports that have to do with Pigeon Lake. You can also choose from river sub-basins, if you happen to know what basin you are located in (e.g. North Saskatchewan, Oldman, etc.). If the water quality station number is known, you may enter the number in the search box at the bottom of the page. The second list shows a list of water "types", from rivers and streams to wastewater and groundwater. Select the parameters you are interested in, holding down the shift or control keys to make multiple selections. This will tell you when the last sample has been taken, what parameters were tested for, and where geographically the waterbody was sampled. Water quality data collected during listed sampling events is however not available from this site. For information on listed sampling events, refer to the "Lake Water Quality Data" option.

Clicking on the "**Lake Water Quality Data**" will bring up a drop down menu from which you select the name of your lake of interest. If your lake is not listed, it either has not been sampled or the data has not been put on the website. For any lake listed, you will have the option of accessing "**Detailed Data**" or "**Average Annual Trophic Data**". A description of the information available from either of these options is provided. Note that there is a small envelope at the top of the screen, click on this to export the data into a spreadsheet that can be saved onto disk, or the data may be printed directly from the website.

Clicking on "**Trophic State of Alberta Lakes**" will bring up a table that lists total-phosphorus and chlorophyll-a concentrations for a number of lakes across Alberta. Scrolling to the bottom of the table reveals links to various graphs illustrating a comparison of the trophic status of these lakes. Graphs can either be brought up showing lakes sorted by trophic status or by lake name.

Clicking on "**River Network Water Quality Data**" will yield a list of rivers in Alberta, simply click on the river of interest and a spreadsheet of data showing the most commonly sampled parameters will appear.

If you cannot find the data you are looking for, you may contact the following:

Ron Tchir
Water Management Group
Alberta Environment
Edmonton, AB
Phone: 780-427-1933
Email: **swq.requests@gov.ab.ca**

The mailing address is:

Information Centre
Main Floor, 9820 – 106 Street
Edmonton, Alberta T5K 2J6
Email: **env.infocent@gov.ab.ca**
Phone: 780-427-2700 (toll free, dial 310-0000)
Fax: 780-422-4086

3. Alberta Environment (AENV)

What is available?

Alberta Environment does water quality testing on some of the lakes that are located within provincial parks. Department of Tourism, Parks and Recreation collects samples for AENV's Provincial Parks Lake Monitoring Program. Data is stored, evaluated, and reported on by AENV.

How can this information be used in a State of the Watershed Report?

This data can be used to provide baseline (historical) information or supplement the water quality data obtained from other sources to help determine the overall water quality and health of the lake/watershed of interest.

How to obtain this information?

This data is available for public use. Contact:

Ron Zurawell
Water Quality Specialist
Alberta Environment
7th Floor Oxbridge Place
9820 – 106th Street
Edmonton, Alberta T5K 2J6
Phone: 780-427-2662
Fax: 780-422-6712
Email: **ron.zurawell@gov.ab.ca**

4. Atlas of Alberta Lakes

What is available?

The Atlas of Alberta Lakes is a complete listing of the majority of the larger sized lakes in Alberta. It was completed in 1990 by Dr. E. Prepas and P. Mitchell from Alberta Environment. It contains all of the data currently available on the lakes at the time, from water quality data, to wildlife, land use, watershed characteristics, area history and more. In 2004 – 2005, the Atlas was made available online for easy reference.

How can this information be used in a State of the Watershed Report?

The Atlas can be extremely useful in State of the Watershed reporting, as it synthesizes all the information available for a particular lake up until 1990. This means that any other searches for information can be narrowed to 1990 to present, and a complete bibliography is listed for each lake, which allows for easy library searching if a review of the entire reference is desired. It covers a wide array of topics which can be included in the many different sections of a State of the Watershed report, as listed in the previous section.

How to obtain the information?

Navigate to the following website: http://sunsite.ualberta.ca/Projects/Alberta-Lakes/

Once there, go to the "Quick Search" option of the menu on the left side of the page and either use the drop down menu to choose your lake of interest, or click on the first letter of the name of the lake and then use the drop down menu, in order to narrow the search.

Once you have found your lake of interest, the information is divided into seven sections with a link provided for you to jump from section to section. The information must be copied and pasted directly off the site; there are no PDF versions available for download.

The contact information is missing from the site, but the Department of Biological Sciences can be reached at:

Department of Biological Sciences
CW 405, Biological Sciences Centre
University of Alberta
Edmonton, Alberta T6G 2E9
Phone: 780-492-3308
Fax: 780-492-9234

5. Regional Health Authorities

What is available?

The Regional Health Authorities monitor water quality from municipally designated public beaches weekly throughout the summer recreational season. The parameters monitored are most commonly fecal coliforms, but in the case of blue green algae, toxins may be analyzed.

Records of all beach closures are kept as well.

How can this information be used in a State of the Watershed Report?

This data can be used to augment existing water quality data from other sources and will identify areas of concern with regards to fecal contamination in recreational waterbodies.

How to obtain this information?

There are 9 different health authorities within the province. Requests for information should be directed to the Regional Health Authority in the area of interest. Go to http://www.health.alberta.ca/regions/HS_locate.html and either click on your regional health authority, or click on the area of the map where the area of interest is. There is also a drop down menu that lists cities and towns; you can also select the town nearest to your site and you will be given the contact information for the appropriate regional health authority.

Since privacy has become an issue, there may be certain protocols that have to be followed in order to obtain this information, including formal request forms and approvals. Names of areas that have been tested around named properties will likely be removed or blacked out to protect the landowner's privacy.

6. **Environment Canada**

   Environment Canada is responsible for collecting surface water quality at trans-boundary locations and in the National Parks. For further information, contact Gary Dunn at 306-780-8468.

7. **AESA Stream Reports** — See State of the Watershed Report Section: Geology, Topography and Soils
8. **NEOS Library Consortium** — Please see the Libraries section
9. **Google and/or Google Scholar** — Please see the General Resources section

Water Quantity and Allocations

1. **Alberta Environment**

   What is available?

   The Alberta Environment River Forecast Centre provides near-real time preliminary information on discharge (flow) and lake levels from various river and lake monitoring stations and across the province. Recent precipitation information and other miscellaneous information for some monitored sites may also be available.

   How can this information be used in a State of the Watershed report?

   This information can be used to assess current water levels of a lake or river in your watershed. Understanding how a local waterbody reacts to changing conditions, combined with climate and land use data, will assist in identifying potential remediation options for consideration in a management plan.

   How to obtain this information?

   Visit the Alberta Environment River Forecast Centre website at: http://environment.alberta.ca/apps/basins/default.aspx.

   From the drop down menus you can choose the basin of interest and the type of data. This will bring up a map of stations (colored dots on the map) that are monitored in that basin. Click on the station of interest to see the data.

You can choose to display the information in either table or figure format. Information in the table format is near real time (ie: usually only a few hours old) and only goes back a few days. You can save the data by right clicking and saving. Selecting the figure format will display current year stream discharge or lake level information along with the historical average over that same period.

Station-specific flow and meteorological data for the most recent period not available from the Water Survey of Canada website (ie: data dating back to approximately 1 year) may also be available from Alberta Environment upon request.

Alberta Environment also maintains a database of miscellaneous lake level information collected during past monitoring projects and programs. To determine whether miscellaneous lake level data exists for your lake of interest, or to request other mentioned information not available on the Alberta Environment website, you may contact:

Karl Runions
Senior Technologist — Water Branch
Alberta Environment
Edmonton, AB
Phone: 780-427-2046

For more information or questions, contact the Information Centre.
Phone: 780-427-2700 (toll free, dial 310-0000) | Fax: 780-422-4086
Hours of operation: Weekdays, 8:15am – 4:30pm

2. Water Survey of Canada

What is available?

The Water Survey of Canada has several data products and services available online. The data available includes near-real time river/stream and lake water levels, as well as archived river/stream discharge (flow) and lake levels.

How can this information be used in a State of the Watershed Report?

By knowing water discharge/level over a number of years you can determine if current water discharge/levels are different from the historical average or if any difference can be associated with natural fluctuation. This will help determine future management planning and best management practices

How to obtain this information?

Go to: http://www.wsc.ec.gc.ca/products/main_e.cfm?cname=products_e.cfm.

Here you can choose to search archived or real time hydrometric data by clicking on the appropriate link. This site also has a feature that allows the user to generate water level and stream flow statistics for any stationed listed.

To use the "**Archived Hydrometric Data — Query the database on-line**", or the "**Generate statistics for selected hydrometric station**" you will need to enter the station name or number. If you do not know that station name or number, you can click on the "Advanced Search" tab, then on the 'location search' tab.

You can then select "Alberta" from the drop down menu next to "Province or Territory". Click "Next" at the bottom of the page. This will bring up a list of stations in Alberta. Select the station of interest then click 'Obtain Report' at the bottom of the page. From here you can choose to print the data and view/download graphs.

If you chose to search real time data you will need to select "Alberta" from the drop down menu. This will bring up a list of active stations. Select the station of interest then follow the instructions on the page. You can also search for your station via the link entitled "Maps of real time hydrometric data".

For more information you can contact:

Dennis Lazowski
Phone: 403-292-5317
Fax: 403-292-5314
Email: **Dennis.Lazowski@ec.gc.ca**

3. Alberta Environment — Applications and Approval Viewer

What is available?

Here you can view applications and approvals for water licenses from water bodies across Alberta. Water licenses can be for diversions or transfers.

How can this information be used in a State of the Watershed Report?

This information can be used to determine how much water is being withdrawn from a waterbody(s) within your watershed. You can also determine what the water is being used for.

How to obtain this information?

Go to: http://environment.alberta.ca/1057.html

After you have read the disclaimer you can click on 'OK to proceed'

Complete a search for your waterbody.

If you are unable to view an application/approval online or if you have any questions you will need to contact your local Alberta Environment Office.

Northern Region
Edmonton
Twin Atria Building
#111, 4999 – 98 Avenue
Edmonton, Alberta T6B 2X3
Phone: 780-427-7617
Fax: 780-427-7824

Southern Region
Calgary
#303 Deerfoot Square Building
2938 – 11 Street, N.E.
Calgary, Alberta T2E 7L7
Phone: 403-297-7602
Fax: 403-297-6069

Central Region
#304, Provincial Building
4920 – 51 Street
Red Deer, Alberta T4N 6K8
Phone: 403-340-7052
Fax: 403-340-5022

Water Management Operations
Second floor, Provincial Building
200 – 5 Avenue South
Lethbridge, Alberta T1J 4L1
Phone: 403-381-5300
Fax: 403-381-5969

4. **Atlas of Alberta Lakes** — Please see State of the Watershed Report Section: Water Quality

Waterfowl Presence and Habitat

1. **Ducks Unlimited Canada**

What is available?

Ducks Unlimited Canada provides information on waterfowl occurrence and habitat. Interactive maps are available for current wetland inventory programs and boreal forest projects. A migration routes map is also available. There is also information on current projects and protected areas in Alberta.

How can this information be used in a State of the Watershed Report?

Ducks Unlimited can be used to determine the waterfowl that occur in your watershed and to identify the habitat that is critical for those species. This can be used for future watershed management decisions. If a wetland inventory has been completed for your watershed, or part of your watershed the information can be used to determine the health and status of wetlands in the area. The information can also be used for future watershed management decisions and possible restoration projects.

How to obtain this information?

Visit the Duck Unlimited Canada (DUC) website: http://www.ducks.ca/

For a list of DUC resources available to you go to: http://www.ducks.ca/resource/index.html

To access the interactive maps go to: http://maps.ducks.ca/

For information on DUC projects in Alberta go to: http://www.ducks.ca/province/ab/projects/index.html

If you are unable to find any information pertaining to your watershed it is best to contact a DUC office nearest to you. The DUC Alberta offices are as follows:

Provincial Office
200 – 10720 178 St NW.
Edmonton, Alberta T5S 1J3
Phone: 780-489-2002
Fax: 780-489-1856

Calgary
3520 – 114th Avenue SE
Calgary, Alberta T2Z 3V6
Phone: 403-201-5577
Fax: 403-201-5580

Grande Prairie
9615 – 105 Street
Grande Prairie, Alberta T8V 6V5
Phone: 780-532-7960
Fax: 780-532-0427

Western Boreal Program
17958 – 106 Avenue
Edmonton, Alberta T5S 1V4
Phone: 780-489-8110
Fax: 780-443-6236

2. **Hinterlands Who's Who and Canadian Important Bird Areas (IBA)**

What is available?

Through these two sources you can determine if there are any bird sanctuaries or important bird areas within your watershed.

How can this information be used in a State of the Watershed Report?

This information can be used to determine protected and important bird areas in your watershed. These will need to be incorporated into future planning initiatives.

How to obtain the information?

For hinterlands Who's Who, go to: http://www.hww.ca/hww2.asp?pid=0&id=231&cid=4 Click on the link to 'Migratory Bird Sanctuaries' then on the link calls 'MBSs.' A map of migratory bird sanctuaries in Canada will pop-up. Ensure that pop-ups are enabled for this site.

For the IBA site got to: http://www.bsc-eoc.org/iba/IBAsites.html On the left side of the page there is a search box. Restrict your search to Alberta then click on the 'Show IBA List' button. A list of important bird areas in Alberta will appear.

3. **Alberta Conservation Association** — please see **State of the Watershed Report Section: Wildlife and Species at Risk**

Wildlife and Species at Risk

4. Alberta Conservation Association

What is available?

The Alberta Conservation Association (ACA) provides reports such as wildlife, fish and habitat surveys from across the province. These reports are available free of charge from the ACA website and additional information may be obtained through contacting local area ACA offices around the province.

How can this information be used in a State of the Watershed Report?

This information will provide State of the Watershed Report writers with information regarding wildlife populations, species at risk, fish presence and habitat, which can provide valuable information regarding what is appropriate for land use in that particular watershed. Areas of concern that are used regularly by wildlife can be preserved and protected from land use changes, and fisheries management and population maintenance can be incorporated into the report.

How to obtain the information?

The reports can be accessed by navigating to the following website:

http://www.ab-conservation.com/aca_reports.html

On this page, you will be required to choose what type of report you are looking for, and can enter a keyword, such as a location name, in order to narrow your search.

There are numerous ACA offices around the province, such as Peace River, Red Deer, Cochrane and many others, which may have information that is not posted on the website. The main office can be reached through this address and phone number:

101 – 9 Chippewa Road
Sherwood Park, Alberta T8A 6J7
Phone: 780-410-1999
Toll free: 1-877-969-9091
Fax: 780-464-0990
Email: **info@ab-conservation.com**

The following link can be used to obtain contact information for an ACA office in your area:

http://www.ab-conservation.com/contact/contact.asp

2. Species at Risk Act (SARA)

What is available?

The SARA website provides information on the status of 'At Risk' species in Canada, their distribution, habitat, biology, threats to the species and recovery planning. You can search for information on a particular species or for the presence of at risk species in a particular region via an interactive map. There are also detailed status reports available from the SARA Public Registry.

How can this information be used in a State of the Watershed Report?

The mapping application will help you determine the presence of SARA Schedule 1 species (endangered, threatened, and special concern risk categories) that currently or historically occur in a watershed. Habitats that are used by species at risk can be preserved and protected from land use changes and population maintenance can be incorporated into the report.

How to obtain the information?

1. Go to the following website: http://www.speciesatrisk.gc.ca/default_e.cfm

   Now you can either Search by Species or Search by Map by clicking on one of the links found on the left side of the page.

   a. If you chose to search by species, enter in the Latin (e.g. *Ursus arctos*) or common name (e.g. grizzly bear) in the appropriately labeled box. Scroll to the bottom and click the search button. You can also choose the taxonomic category, risk category and/or distribution. If your search returns more than one result, click on the search result that you want to view.

   b. If you choose to search by map, read through the 'Data Description and Limitations', 'Disclaimer' and 'How to Perform a Search by Map' sections. To begin your search click on the 'Begin a Search' link. The 'How to Perform a Search by Map' has step by step instructions on how to conduct a search.

2. Once you have identified the species at risk that occur in your watershed you can obtain detailed status report from the SARA Public Registry. The registry can be found at:

   http://www.sararegistry.gc.ca/

   a. To enter the site, choose English or French.

   b. Near the top of the page there are two search boxes. In the one on the left (with the down arrow), ensure that the 'species' option is selected. In the box on the right (labeled keyword) enter the Latin or common name of the species that you are looking.

   c. If your search returns more than one result select the link of the exact species you wish to view. This will take you to a Species Profile page. On this page you can scroll down and select the reports that you wish to view. These reports are available for download in PDF format.

The Canadian Wildlife Service can be contacted directly at:

Canadian Wildlife Service
Environment Canada
Ottawa, Ontario K1A 0H3
Telephone: 819-997-2800 or 1-800-668-6767
Fax: 819-994-1412
TTY: 819-994-0736
Email: **enviroinfo@ec.gc.ca**

3. Alberta Fish and Wildlife — Sustainable Resource Development

What is available?

SRD perform various surveys to monitor the status of numerous wildlife species throughout Alberta.

Similar to the fisheries data, information on wildlife may exist in the form of finished reports or as data within the provincial Wildlife Habitat Management Information Systems (WHMIS) database. Depending upon the size of the geographic area of interest, staff may be able to perform a WHMIS search of the local area and/or watershed to identify additional wildlife information and/or projects/studies of interest.

Types of information available include:

- Information on Species at Risk, including status and distribution.
- Surveys of colonial nesters (eg: grebes, herons, pelicans, trumpeter swans, cormorants, etc...), and raptors (eg: golden eagles, peregrine falcons, etc...).
- Aerial surveys of ungulates (eg: moose, caribou, etc...).
- Habitat maps identifying specific habitat features (eg: snake hibernacula's) and/or habitat range of high profile species (eg: caribou, grizzly bears).
- Records from annual volunteer wildlife monitoring programs, such as amphibian and owl surveys.

There are currently Wildlife Management Plans for eleven recreational hunted species in Alberta, as well as harvest and effort records. You can search the Status of Alberta Wildlife. This is useful after you already know what wildlife occur in your watershed. There are also detailed status reports available for several species of bird, mammal, fish and invertebrate species. Information regarding Species at Risk is available, including status and distribution.

How can this information be used in a State of the Watershed Report?

This information will provide State of the Watershed Report writers with information regarding wildlife populations, species at risk and habitat, which can provide valuable information regarding what is appropriate for land use in that particular watershed. Areas of concern that are used regularly by wildlife can be preserved and protected from land use changes, and fisheries management and population maintenance can be incorporated into the report.

How to obtain this information?

Wildlife Management Plans can be obtained from:
http://www.srd.gov.ab.ca/fishwildlife/livingwith/huntingalberta/default.aspx

Click on the 'Wildlife Management Plans' link at the bottom left of the page.

Status reports are available at: http://www.srd.gov.ab.ca/fishwildlife/status/default.aspx

Here you can click on a link to birds, mammals, fish, invertebrates, reptiles, etc. A list of species that have detailed status reports available will appear. Click on the species of interest.

Species at Risk in Alberta can be found at:
http://www.srd.gov.ab.ca/fishwildlife/speciesatrisk/default.aspx

Here you can find general and detailed statues reports, legal designations and information on projects undertaken by the Species at Risk Program.

For more information on your specific watershed you can contact a Fish and Wildlife office near you. A list of offices can be found at: http://www.srd.gov.ab.ca/informationcentre/offices.aspx. As well, there is a provincial Wildlife Management Area Contacts map available in which the local Wildlife staff members are identified, and their contact information provided. The map is in PDF format and can be found at:
http://www.srd.gov.ab.ca/fishwildlife/guidelinesresearch/managementareacontacts.aspx

General Resources

1. Google Scholar

What is available?

Many peer reviewed scientific journals can be found on Google Scholar, which will include any studies or articles relating to water quality, groundwater, hydrology, wildlife, plants, and others.

How can this information be used in a State of the Watershed Report?

This information can add to the validity of a perceived problem in a particular watershed, or can simply provide background information regarding a particular topic.

How to obtain the information?

The Google Scholar website can be found at: http://scholar.google.ca/

You must enter in keywords in order to begin a search. For instance, you may enter "Lesser Slave Lake water quality", click on "Search", and any articles relating to that topic will appear. Often if the article is contained in a peer reviewed journal there will be a cost associated with obtaining the article unless you have a valid library card that can be used at the University of Alberta Libraries.

2. Google Earth

What is available?

Google Earth is a free program that can be used in order to obtain satellite imagery of any area in the world. Users can enter in a place name and zoom right in on details in the landscape; some areas even have 3D views available. Features can be toggled on or off, such as roads, tourism information, campgrounds, borders, and many others.

How can this information be used in a State of the Watershed Report?

Google Earth can give State of the Watershed report writers an aerial view of their site of interest which may not otherwise be available by archived aerial photo, or which may be more recent. This may assist with some preliminary determination of land use activities, shoreline development and vegetation cover in the area.

How to obtain the information?

Navigate to http://earth.google.com/ and download the free Google Earth program by clicking on the "Downloads" link on the left hand side of the webpage. Click on "Agree and Download" to accept the terms of use and begin the program download.

Once the program has been set up on your computer, open Google Earth, and in the white bar at the top left hand side of the page, type the location you are looking for, e.g. Pigeon Lake, Alberta. Try to include the full proper name and province for a more accurate search. You should be under the "Fly To" tab. Click on "Search" and the program will display the location you are looking for. Screen snapshots can be saved to your computer by clicking "File" then "Save Image", then naming the file and clicking "Save" to save the file on your computer.

3. **Royal Alberta Museum**

What is available?

The Royal Alberta Museum conducts research in areas such as fisheries, wildlife and archaeology all across the province. Many of their reports are online and are available free of charge.

How can this information be used in a State of the Watershed Report?

This information can be used to supplement information in the wildlife, birds and fisheries section of a report, and could be used to provide some historical information regarding the area of interest.

How to obtain this information?

The publications can be found on the following webpage:

http://www.royalalbertamuseum.ca/vpub/intro.htm

For obtaining information not available on the website, it is best to contact the curators in the subject area of interest directly. A complete listing of all museum employees can be found at:

http://www.gov.ab.ca/home/includes/directorysearch/goaBrowse.cfm?txtSearch=Community%20Development&Ministry=COMDEV&levelID=6196

4. **Canadian Council of the Ministers of the Environment — Canadian Environmental Quality Guidelines**

What is available?

The Guidelines list safe limits for contaminants in soils, water and tissue based on recreational and agricultural uses, aesthetics, protection of aquatic life and human health. Contaminants include hydrocarbons, pesticides, nutrients, bacteria and other chemical compounds.

How can this information be used in a State of the Watershed Report?

This information would be used to compare available water quality data with guideline limits to determine if there are any areas of concern. Comparisons would be made to the guidelines that are most applicable, e.g. if your area of interest is Sylvan Lake, you would likely compare to the Recreation and Aesthetics Guidelines. Some of the guidelines may require the interpretation of a professional, such as an aquatic biologist or a limnologist/water quality specialist from Alberta Environment.

How to obtain this information?

Summary tables are available at: http://www.ccme.ca/publications/ceqg_rcqe.html?category_id=124

The explanations behind these guidelines are not provided; the full version is only available by purchase. The entire guidelines are available for $295.00 and can be purchased through the following website:

https://secure.encryptedtransactions.com/dfocus/ccme/eng/ordering.cfm?selectedCat=CCM-CEQ-

CCME can be reached at:

Canadian Council of Ministers of the Environment
123 Main Street, Suite 360
Winnipeg, Manitoba R3C 1A3
Phone: (204) 948-2090
Fax: (204) 948-2125
Email: **info@ccme.ca**

5. Alberta Ingenuity Center for Water Research

What is available?

The AICWR Literature Review of Alberta Watershed Research is a searchable database dedicated to identifying publications and grey literature related to Alberta's watersheds. There are about 7000 records related to agriculture, climate change, economics, erosion, floods, forestry, forests, grassland, groundwater, human health, irrigation, recreation, riparian areas, water quality, water supply, water use, wetlands, wildfire, and wildlife among others.

How can this information be used in a State of the Watershed Report?

This information can be used to augment many different sections of a State of the Watershed Report, as listed above. The AICWR may provide literature that would otherwise be missed during other general searches.

How to obtain this information?

Navigate to: http://www.aicwr.ca/search/index.cfm

Enter in your keywords (i.e. "Pigeon Lake"). You may also enter in other search parameters such as author name and year published. A general search can be completed by watershed, just choose your watershed from the list provided in the drop down menu.

Contact information is as follows:

Deirdre Coburn
Research Centre Manager, AICWR
University Hall, Room D610
University of Lethbridge
Lethbridge, Alberta T1K 3M4
E-Mail: **dcoburn@aicwr.ca**

Libraries

1. NEOS Consortium

What is available?

NEOS is a library consortium that consists of government, hospital, college and university libraries across Alberta. Users are able to search an online database for books and reports that are available at these libraries.

How can this information be used in a State of the Watershed Report?

The NEOS Library Consortium is a great tool to use when putting together a State of the Watershed Report. There are publications available on a number of topics including public surveys, water quality, soils, history, fisheries, etc. There are a varying number of publications available for each watershed. It should be the first search performed when starting a State of the Watershed report.

How to obtain this information?

Go to the following website: http://www.neoslibraries.ca/

1. Select 'NEOS Catalogue' from the list of link at the left side of the page.
2. Click on the 'Online Catalogue' link that is within the text of the first paragraph.
3. Now you can select either 'English Login or' French Login'
4. Once you have selected a language a search page will appear. Type a keyword into the search box (e.g. Wabamun Lake). A list of results will appear. You also have the option to select the library that is searched and the year, format and/or language of the publication. Click the 'Search' button.
5. Scroll through your search results and click the 'MARK' button on publications you are interested in. Once you have scrolled through the search results click the 'Marked' link at the bottom of the page. This will bring up a list with the publications that you selected.
6. Click on the 'Print Formatted" button at the right. This will bring the list of publications you chose with the title, author(s), call number and location of each. You can now print this page.
7. To obtain the publication you must go to the library where it is located and sign it out. You will need to get a NEOS library card in order to take out books.

A list of the participating libraries and their addresses can be found at:
http://www.neoslibraries.ca/node/5

2. Eric Marshall Aquatic Research Library

What is available?

The Eric Marshall Library (located on the University of Manitoba campus in Winnipeg, MB) has various publications available from the Prairie and Northern Region. Publications topics include fish populations, habitat and management, water quality and quantity and sediment. Please note that not all subjects will be available for all watersheds.

How can this information be used in a State of the Watershed Report?

Publications from this library can be used towards the fisheries and water quality sections of a State of the Watershed Report. If Fish Management Plans exist for your watershed, they should be incorporated into future planning efforts.

How to obtain this information?

To search the Library catalogue go to:

http://inter01.dfo-mpo.gc.ca/waves2/index2.html?_SID=b69c13755e93a7e1fdff0faeed8d52a0&_LANG=en

Type in your search requirements. Once the list is populated, select the publication you want by checking the box at the right. After you have selected the publications you want, click 'Display' at the top left of the page. This will bring up a list with their locations and call numbers. Under location it should say MWFW, this is the symbol for the Eric Marshall Library.

To obtain the publication you will need to visit your local government library (see the NEOS Library section) and get an inter-library loan.

For questions please contact:

Kerry Macdonald
Regional Librarian
Phone: 204-983-5170
Fax: 204-984-4668
Email: **MacdonaldKM@dfo-mpo.gc.ca**

Jane Martin
Library Technician
Phone: 204-983-5169
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Phone: 204-983-5169
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Email: **library-fwi@dfo-mpo.gc.ca**
Or visit the website at: http://www.dfo-mpo.gc.ca/regions/central/lib-bib/index_e.htm

Appendix B
Examples of State of Watershed Reports and Report Cards

Alberta

Alberta Agriculture, Food and Rural Development. 2005. AESA Stream Survey — Watershed Report: Strawberry Creek in 2005.

Bow River Basin Council. 2005. The 2005 Report on the State of the Bow River Basin. http://www.brbc.ab.ca/issues2.asp

Iron Creek Watershed Improvement Society. 2006. Iron Creak Riparian Health Report Card 2001 - 2006.

Keepers of the Athabasca. 2008. State of the Athabasca Watershed 2008. http://www.keepersofthewater.ca/athabasca/state2008.pdf

Lac La Nonne Watershed Stewardship Society. 2006. Lac La Nonne State of the Watershed Report. http://www.laclanonnewatershed.com/LLN_SoW_Report.pdf

Lakeland County. 2004. State of the Lac La Biche State Watershed 2004: Summary of Current Information. http://www.aquality.ca/pdfs/Aquality_LLB_SoW_2004.pdf

Moose Lake Water for Life Committee. 2005. State of the Watershed Environmental Inventory Report for Moose Lake: Summary of Current Information. http://www.aquality.ca/pdfs/Aquality_Moose_Lake_SoW_2005.pdf

North Saskatchewan Watershed Alliance. 2005. State of the North Saskatchewan Watershed Report. http://nswa.ab.ca/pdfs/sowr.pdf

Nose Creek Watershed Partnership. 2003. Watershed Health Report: Health of the Nose Creek Watershed. http://www.nosecreekpartnership.com/documents/Watershed%20Health%20Report%20Card/Watershed%20Health%20Report%20Card%202002.pdf

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Red-Bow Regional Watersheds Alliance. 2003. Watershed Health Report: Health of the Rosebud River Watershed.

Red Deer River Watershed Alliance. 2008. Red Deer River State of the Watershed Report (draft). http://www.rdrwa.ca/sow.php

Skeleton Lake Stewardship Association. 2007. Skeleton Lake State of the Watershed Report 2007. http://skeletonlake.com/info/Skeleton_SoW_with_App_B.pdf

Other

Ausable Bayfield Conservation Authority. 2007. Ausable Bayfield Conservation Authority Watershed Report Card. http://www.abca.websmart.ca/reportcard.php

Essex Region Conservation Authority. 2005. Watershed Report Card. http://www.erca.org/downloads/watershed_report_card06.pdf

Mackenzie River Basin Board. 2003. State of the Aquatic Ecosystem Report 2003. http://www.swa.ca/Publications/AquaticEcosystem.asp

Muskoka Watershed Council. 2007. The Muskoka Watersheds Report Card. http://www.muskokaheritage.org/watershed/watershedreportcard.asp##2007

Rouge Remedial Action Plan Advisory Council. 1999. Rouge River Report Card. http://www.rougeriver.com/pdfs/rougereportcard.pdf

Saskatchewan Watershed Authority. 2007. State of the Watershed Report. http://www.swa.ca/StateOfTheWatershed/Default.asp

Upper Thames River Conservation Authority. 2007. The 2007 Upper Thames River Watershed Report Cards. http://www.thamesriver.on.ca/Watershed_Report_Cards/Watershed_Report_Cards-2007.htm

Appendix C
References — Watershed Assessment Guides and Manuals

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Conservation Ontario. 2003. Watershed Reporting: Improving Public Access to Information. http://conservation-ontario.on.ca/projects/pdf/reports/PHASE%20I/watershed_reporting.pdf

Frankenberger, J., S. McLoud, and A. Faulkenburg. 2002. Watershed Inventory Workbook for Indiana: A Guide for Watershed Partnerships. https://engineering.purdue.edu/SafeWater/watershed/inventoryf.pdf

Manitoba Water Stewardship Conservation Districts Program. 2004. A Guide to Develop a State of the Watershed Report (Draft). Prepared as part of the Manitoba Conservation Districts Program Integrated Watershed Management Planning Process.

Oregon Watershed Enhancement Board. 1999. Oregon Watershed Assessment Manual. http://www.oregon.gov/OWEB/docs/pubs/OR_wsassess_manuals.shtml#OR_Watershed_Assessment_Manual

Saskatchewan Watershed Authority. 2006. State of the Watershed Reporting Framework. http://www.swa.ca/Publications/Documents/SOWReportFramework.pdf

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United States Environmental Protection Agency. 2008. Handbook for Developing Watershed Plans to Restore and Protect our Waters. http://www.epa.gov/owow/nps/watershed_handbook/#contents

Appendix D
References — Other Information

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Alberta Water Council. 2008. Recommendations for a Water Management Planning Framework for Alberta. http://www.albertawatercouncil.ca/Publications/tabid/59/Default.aspx

Government of Alberta. 2003. Water for Life: Alberta's Strategy for Sustainability. http://www.waterforlife.gov.ab.ca/docs/strategyNov03.pdf

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United States Environment Protection Agency. 2000. Selection of Indicators for Great Lakes Basin Ecosystem Health: version 4. State of the Lakes Ecosystem Conference.

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